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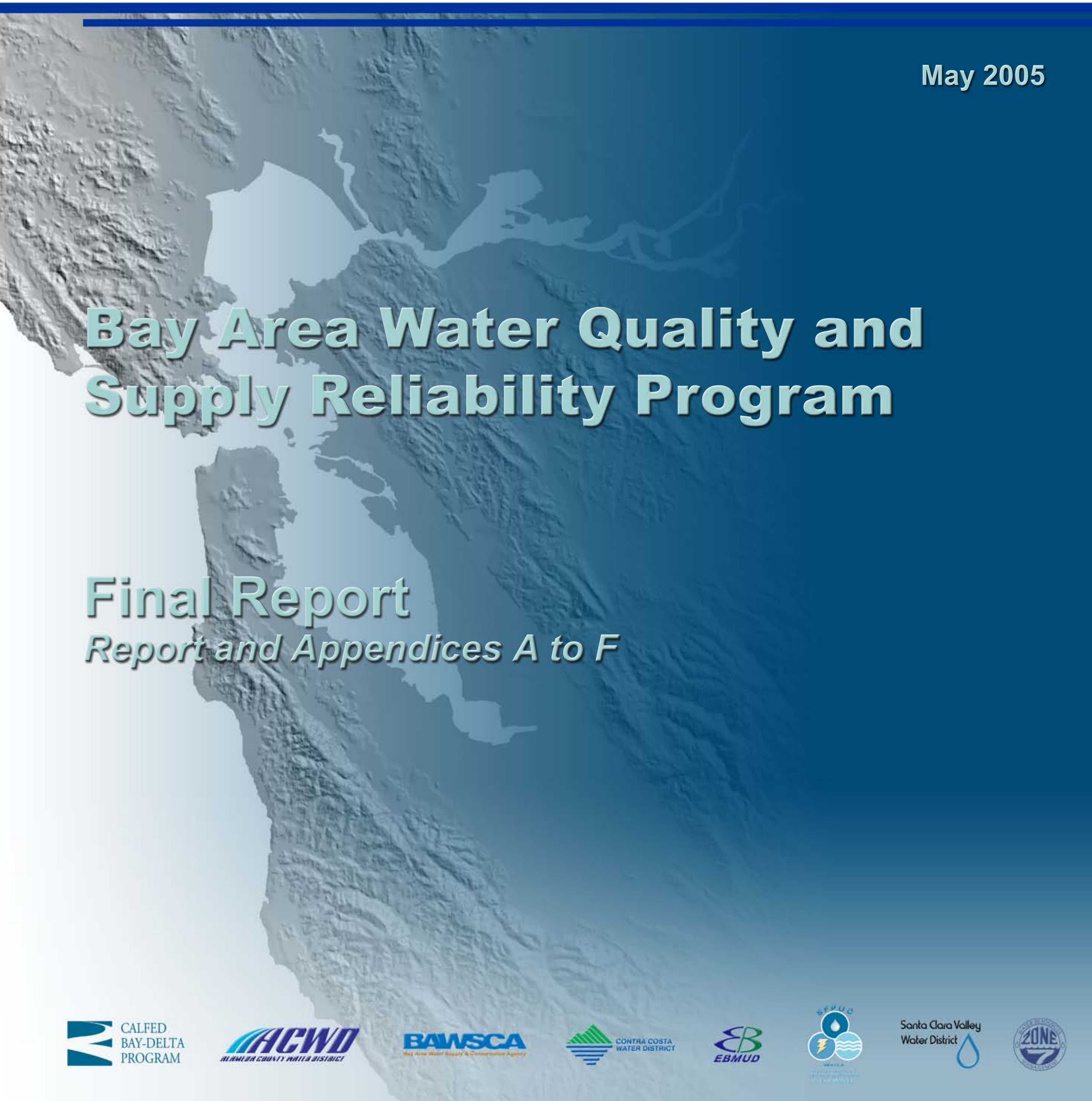
May 2005



Bay Area Water Quality and Supply Reliability Program

Final Report

Report and Appendices A to F

CALFED
BAY-DELTA
PROGRAM

ACWD
ALAMEDA COUNTY WATER DISTRICT

BAWSCA
Bay Area Water Supply & Conservation Agency

CONTRA COSTA
WATER DISTRICT

EBMUD

SFPUC

Santa Clara Valley
Water District

ZONE 7

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May 31, 2005

Ms. Cindy Darling
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Subject: Final Report – Bay Area Water Quality and Supply Reliability Program

Dear Ms. Darling:

Camp Dresser & McKee Inc. is pleased to submit this final Report for Phase 2 of the Bay Area Water Quality and Supply Reliability Program. The report documents Phase 2 efforts to identify and develop regional opportunities in the San Francisco Bay Area for enhancing water quality and water supply.

In Phase 2, the project team worked with the seven participating Bay Area water utilities to further develop and evaluate concepts identified in Phase 1, and grouped concepts into sample portfolios. A comprehensive screening was conducted to first broaden the list of concepts considered and then narrow the list based on participation criteria, including providing benefits to more than one agency, projects not already planned for implementation independently, and projects that are sufficiently mature to be evaluated. Thirty six concepts were retained for detailed evaluation. Conceptual-level engineering and preliminary environmental evaluations were performed to develop detailed information on these concepts and portfolios.

As part of the Phase 2 evaluation, the project team worked with Bay Area Water Agency Coalition to identify program objectives and performance measures. These were further refined and developed in workshops with participating agencies. Using the objectives and performance measures, each concept and five example portfolios developed for groups of concepts, were evaluated to determine how they met program goals and performance objectives. In this process, scorecards were developed for each of the concepts and portfolios, summarizing the concept or portfolio performance with respect to the various Program objectives.

A significant conclusion in Phase 2 of the program is that while viable concepts exist that provide water quality and water supply reliability benefits, there is no simple solution for solving Bay Area water quality and water supply needs. Concepts evaluated in the study, alone or in concert, are not sufficient to achieve the numerical CALFED Record of Decision (ROD) target of 50 μg/L bromide and 3.0 mg/L total organic carbon for diverters from the Delta, indicating that improvement in Delta source water quality will be necessary to meet the long-term objectives in the ROD. In addition, the concepts and portfolios were not able to meet the full future water supply needs of the Bay Area.

The enclosed report documents both the Phase 2 process and the detailed body of information developed for the concepts and portfolios. The report will serve as a valuable information source for agencies as they evaluate their own water resources needs and strategies.

We have appreciated the opportunity to work with you and the Bay Area water agencies on this challenging and very interesting project.

Very truly yours,

Craig Von Bargen

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Patricia Roberson, U.S. Bureau of Reclamation
Stephen Cimperman, California Department of Water Resources

Acknowledgements

CDM would like to acknowledge the assistance and support of the many program participants in the development and evaluation of potential regional project concepts and portfolios under Phase 2 of the Bay Area Water Quality and Supply Reliability Program. The Program included input from BAWAC at key points throughout the study, as well as significant input from CALFED and participant agency staff, who provided background information for the study, valuable input in developing concepts and portfolios, participation in multiple workshops to review key program issues, and review of all project deliverables.

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Executive Summary

Executive Summary

ES-1 INTRODUCTION

ES-1.1 Overview and Background

The Bay Area Water Quality and Supply Reliability Program (Program) was established to identify regional opportunities for enhancing water supply and/or water quality for Bay Area agencies. The program was identified in the CALFED Bay-Delta Program (CALFED) environmental review process, and outlined in the CALFED Record of Decision (ROD) for the Final Programmatic Environmental Impact Statement and Environmental Impact Report (EIS/EIR) (CALFED, 2000), provides for Bay Area agencies to work cooperatively to address water quality and supply reliability concerns on a regionally focused basis. The seven participating agencies are shown in the box to the right. The Program, initially identified as the Bay Area Blending/Exchange (BAB/E) Project, was re-named to the Bay Area Water Quality and Supply Reliability Program at the outset of Phase 2. The Program is considered a complementary action to the CALFED Bay-Delta Program. As such, the Program, though not evaluated in the Final Programmatic EIS/EIR, would help to achieve objectives for water quality and water supply reliability consistent with Bay-Delta Program framework established in the CALFED ROD.

Bay Area Water Quality and Supply Reliability Program Participants

- Alameda County Water District (ACWD)
- Bay Area Water Supply and Conservation Agency (BAWSCA)
- Contra Costa Water District (CCWD)
- East Bay Municipal Utility District (EBMUD)
- San Francisco Public Utilities Commission (SFPUC)
- Santa Clara Valley Water District (SCVWD)
- Zone 7 of Alameda County Flood Control and Water Conservation District (Zone 7 Water Agency)

This report documents Phase 2 of the Program. The Program originally included four phases:

- **Phase 1 – Initial Assessment:** Compile water quality, demand and system data for participating agencies and formulate preliminary list of concepts (completed earlier);

- **Phase 2 – Feasibility Studies:** Evaluate and develop concepts; group concepts into sample portfolios; screen concepts and sample portfolios (current study);

- **Phase 3 & 4 – Detailed Evaluation:** Project selection and development, environmental review, financing, implementation plan, design and operations plan.

To date, neither State nor CALFED funding for Phases 3 & 4 has been authorized. Because of uncertain funding for these phases, Phase 2 developed concept information for participating agencies to use, as they go through their own respective decision-making processes to determine whether to pursue concept implementation.

ES-1.2 Phase 2 Scope of Work

Key tasks for the Phase 2 effort are summarized in Table ES-1.

TABLE ES-1. Summary of Key Tasks and Work Elements for the Bay Area Water Quality and Supply Reliability Program

Task	*Objective*	*Work Elements*	*Discussed in*
1: Refine Objectives	Develop and refine objectives for Phase 2 evaluations	• Develop objectives based on stakeholder involvement • Organize and categorize objectives into primary and sub-objectives • Develop appropriate measurement criteria.	Section 1.5, Appendix F
2: Develop and Coordinate Planning Assumptions	Develop assumptions for future water supply and water quality conditions for use in concept analysis	• Review CALFED and relevant partner planning documents • Prepare technical memorandum summarizing supply and water quality baseline information	Section 2, Appendix B (Demands) Appendix C (Supplies and Water Quality) Appendix D (Water Treatment)
3: Develop Evaluation Framework	Establish framework for evaluating concepts and portfolios	• Refine performance measures • Develop evaluation methods • Develop analysis reporting formats	Sections 1.5, 4.1
4: Develop Concepts and Portfolios	From concepts, develop example portfolios	• Develop preliminary information on concepts identified in Phase 1 • Evaluate concepts for consistency with project goals and objectives • Prepare technical memorandum describing concepts and portfolios	Section 3.1, 3.2
5: Concept and Portfolio Descriptions	Develop concept descriptions and evaluate concepts and portfolios	• Conduct environmental and engineering analysis to develop concepts to a similar level of detail • Document findings in technical memorandum	Section 3.3 Appendix E
6: Concept Evaluations	Analyze concepts and portfolios to allow stakeholders to identify concepts or portfolios to pursue further	• Quantify water quality impacts and benefits of concepts and portfolios • Quantify water supply reliability of concepts • Develop preliminary planning-level economic analysis	Section 4.2 Appendix G
7: Outreach and coordination	Identify and engage affected parties not directly involved in project	• Identify key stakeholder groups • Prepare quarterly updates • Conduct briefings/presentations	Section 1
8: Integration with other CALFED Regional Implementation Plans	Provide technical information and analysis to assist CALFED staff who will integrate several programs	• Provide information and analysis to CALFED staff integrating the overall CALFED water management activities.	Section 1

ES-1.3 Program Objectives and Performance Measures

In separate efforts, the Bay Area Water Agency Coalition (BAWAC) developed objectives and performance measures for the Program. These objectives and performance measures were also reviewed with the individual participating agencies. The environmental water caucus and environmental stakeholder representatives have also developed preliminary objectives and performance measures which further expand upon the environmental objectives developed by BAWAC.

Five primary objectives were identified to express the shared mission of the participating agencies. Within each of these primary objectives, more detailed secondary objectives were developed. Substantial input was provided by technical support staff from BAWAC member agencies in the development and wording of these sub-objectives.

To determine the potential benefits or impacts to agencies resulting from implementation of a concept or portfolio, each of the concepts and portfolios was evaluated with respect to the five objectives and the specific sub-objectives developed to measure project performance for each objective, using a mix of quantitative and qualitative measures. Results of the evaluations were compiled into comprehensive tables for each concept and example portfolio, termed "scorecards." The five objectives and specific evaluations performed to develop scorecards are summarized in Table ES-2.

The scorecards are intended to provide each agency with the information required to make determinations as to whether each concept and example portfolio alternative merits additional study and possible future implementation.

TABLE ES-2. Summary of Program Objectives and Concept Evaluations Performed

Objective	*Types of Analysis Performed*
Supply Reliability	• Quantitative analysis of monthly supply for extended drought and critical drought years. • Qualitative assessment of reduction in system vulnerability and degree of local control.
Public Health Protection	• Quantitative analysis of key source water constituents (TOC, bromide, TDS) and treated water constituents (trihalomethanes [THM4], haloacetic acids [HAA5], bromate) • Qualitative analysis of parameters that could affect treatment (pH, temperature) or taste and odors.
Cost Impacts	• Quantitative assessment of capital, operating and maintenance, environmental mitigation and life-cycle costs.
Environmental Impacts	• Programmatic-level evaluation of potential impacts to aquatic or terrestrial resources, wetlands, special status species and energy consumption.
Implementation Potential	• Qualitative assessment of degree of external support, opportunities for funding and consistency with agency or regional plans.

ES-2 PLANNING ASSUMPTIONS AND BASELINES

Figure ES-1 shows the study area, which includes the service areas of the seven participating agencies. Four of the participating agencies, ACWD, BAWSCA, SFPUC and SCVWD, overlap. ACWD and all BAWSCA member agencies (of which ACWD is a member agency) purchase wholesale water from SFPUC and are part of the SFPUC regional service area. Eight BAWSCA member agencies[1] located in Santa Clara County and either purchase wholesale water from SCVWD or pump water from groundwater basins managed by the SCVWD, and are part of the SCVWD service area.

The study uses a 2020 planning horizon. This time-frame was selected because it coincides with most participating agencies' current planning horizon. Current population for the service area is 5.5 million, with a projected 16 percent increase by 2020 to 6.3 million. Water use is projected to increase by about 15 percent, from 1.07 Million acre-feet/year (MAFY) to 1.24 MAFY. Per capita water use will remain relatively constant.

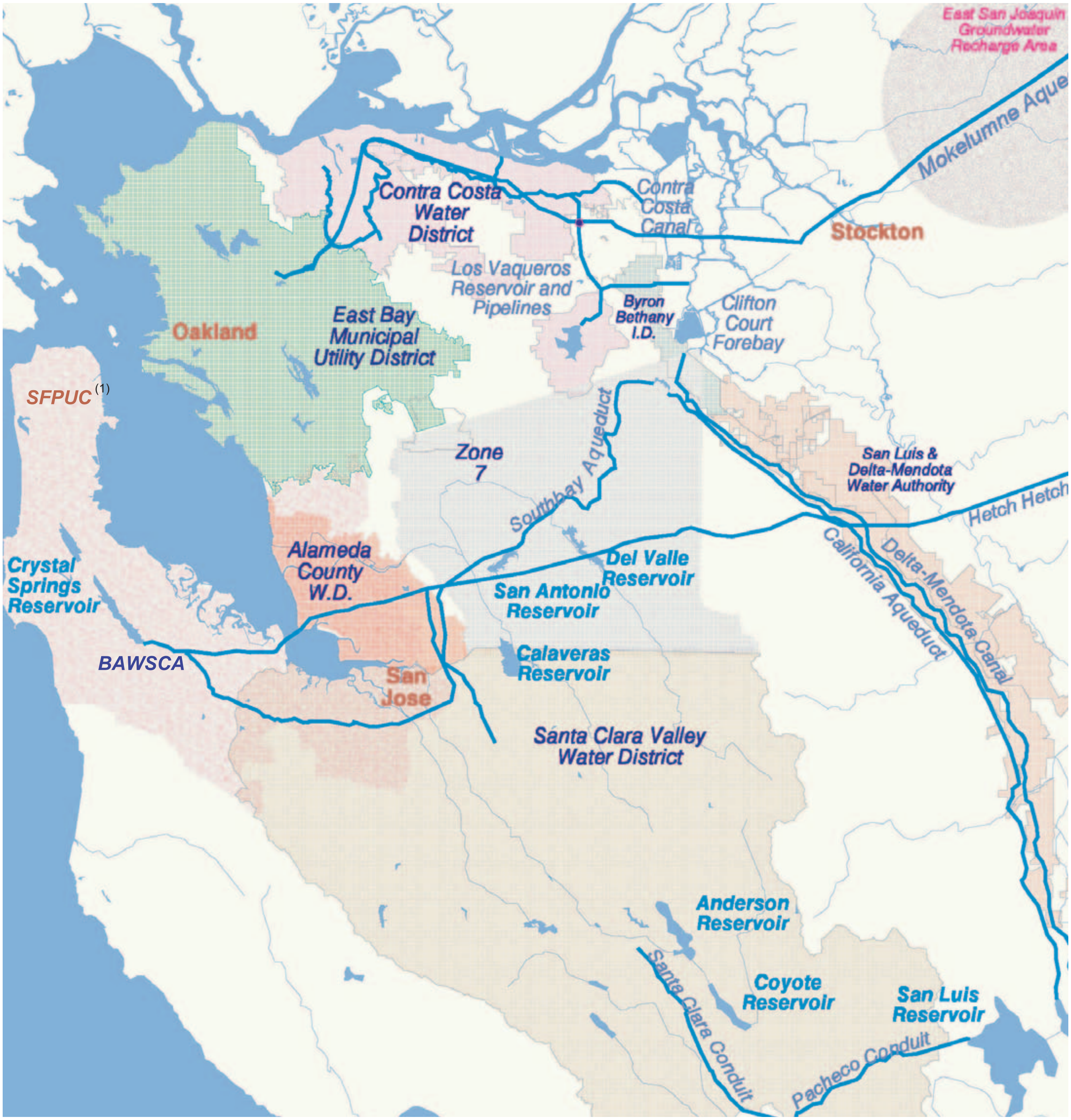
Future agency baseline supply and water quality conditions were established to represent the year 2020 projected supply and water quality conditions for each agency's major sources of supply. Supply and water quality baselines were developed for two drought hydrologic conditions (critical dry year, similar to 1977 conditions and extended dry year, similar to 1987 through 1992 conditions) and for average year hydrology.[2] Three source water quality constituents: total organic carbon (TOC), total dissolved solids (TDS) and bromide were selected as key water quality parameters, based on their influence on disinfection by-product generation and aesthetics.

Project concepts were identified to help meet water quality and supply reliability needs. Combinations of projects (example portfolios) were also developed. Each of the project concepts and example portfolios was analyzed to determine the incremental water quality and water supply benefits, as compared with baseline conditions. Projected water quality impacts and/or benefits associated with concepts and example portfolios were evaluated both before and after treatment, with each agency's assumed treatment processes in place for year 2020 conditions.

---

[1] Milpitas, Mountain View, No. San Jose, Santa Clara, Palo Alto, Purissima Hills, Stanford and Sunnyvale.

[2] Because of the variety of sources of water used in the Bay Area, agencies use different hydrological conditions as their "worst case" for planning purposes, and the three sets of conditions used in this study may not include an agency's worst case.



(1) SFPUC also serves the 28 customers represented by BAWSCA, including ACWD.

Note: Figure courtesy of EBMUD.

Figure ES-1
Participating Agencies and Service Areas

ES-3 DEVELOPMENT OF PHASE 2 CONCEPTS AND EXAMPLE PORTFOLIOS

Phase 1 of the Program identified several categories of concepts and proposed initial concepts for each category. In Phase 2, the concepts were refined, and categories reframed to more appropriately group the concepts. Through this process, additional concept detail was developed, and new concepts were added. Figure ES-2 illustrates the concept development process.

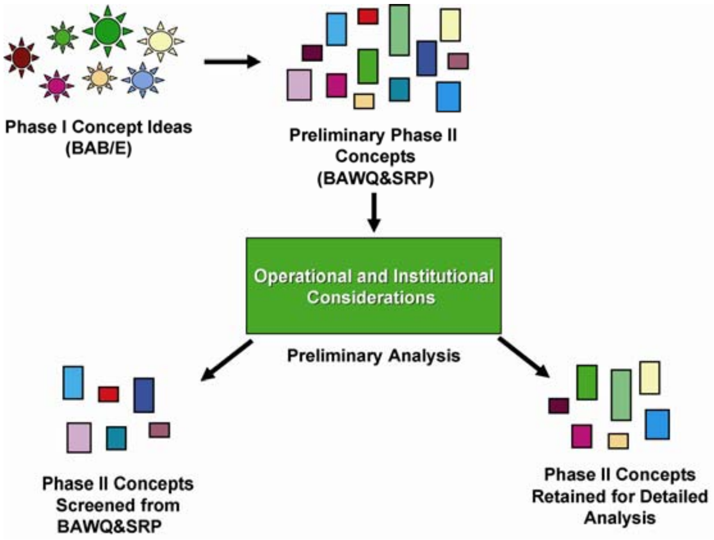

Phase I Concept Ideas (BAB/E)
Preliminary Phase II Concepts (BAWQ&SRP)
Operational and Institutional Considerations
Preliminary Analysis
Phase II Concepts Screened from BAWQ&SRP
Phase II Concepts Retained for Detailed Analysis

Figure ES-2
Concept Development Schematic

Once project concepts were identified, and sufficient detail was developed to evaluate the benefits and impacts of these concepts to the participating agencies, concepts were grouped into examples of synergistic combinations, termed "example portfolios," with the goal of maximizing potential benefits through regional cooperation. Portfolios were developed using the two principal Program goals: improvement of water quality and water supply reliability. Figure ES-3 illustrates the portfolio development process.

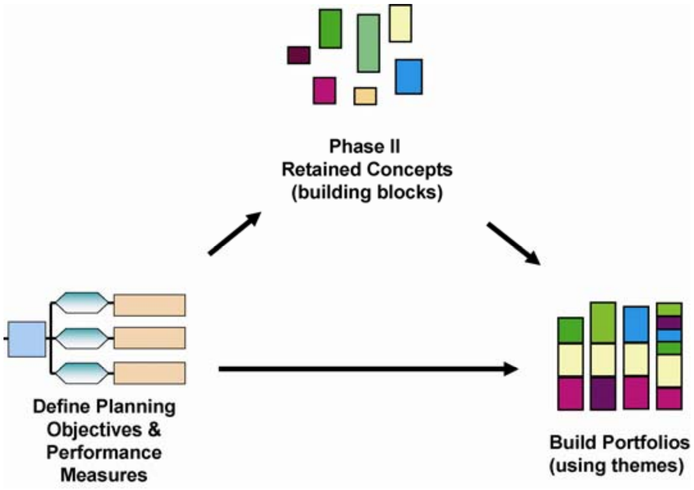

Phase II Retained Concepts (building blocks)
Define Planning Objectives & Performance Measures
Build Portfolios (using themes)

Figure ES-3
Example Portfolio Development

ES-3.1 Concepts

Phase 2 concepts can generally be grouped by water management approach, in the following seven categories:

- **Groundwater Storage/Conjunctive Use:** Optimization of surface and ground water supplies, commonly using groundwater banking, in which the aquifer is recharged with surplus surface waters in wet years, and is stored for use in dry years.
- **Surface Water Storage:** Maximizing surface water storage capabilities and associated conveyance facilities to meet demands with high quality water. These project concepts may provide value for water quality, dry year supply, and emergency supply.
- **Enhanced Conservation:** Each of the Bay Area partners has developed ongoing conservation programs as part of their demand management strategy, with estimated water use savings of 180,000 acre-feet per year (AFY) by the year 2020. The Enhanced Conservation Concept includes activities above and beyond the 180,000 AFY that could potentially augment current conservation programs undertaken and planned to be undertaken by the Bay Area partners.

- **Water Recycling:** Reuse of treated wastewater to offset potable water demands. A variety of uses have been identified, including irrigation and industrial cooling.
- **Desalination:** Removal of salts and minerals from water, generally accomplished by reverse osmosis.
- **Conveyance:** Use of new or expanded conveyance facilities to improve water quality and/or water supply reliability.
- **Other:** Concepts considered which do not fall within one of the six categories described above.

Sixty-nine concepts were included in the Phase 2 preliminary screening. Initial Phase 2 concepts were evaluated and subjected to preliminary screening based on three criteria established by the technical team and participating agencies:

- Concepts must benefit more than one participating agency;
- Concepts cannot already be approved for implementation independently from this study (e.g., already included in a master plan or capital improvement program);
- Concepts must be sufficiently mature to evaluate in this study.

Those concepts failing to meet Program requirements, deemed infeasible by the participating agencies, or failing to mature were screened from the Program. Thirty six concepts were retained for detailed evaluation in Phase 2. Table ES-3 and Figure ES-4 summarize the retained concepts.

TABLE ES-3. Phase 2 Retained Concepts

Concept	Description
Surface Water Storage	
Calaveras Reservoir Expansion	Expansion to 420,000 acre-feet (AF). Two operating options included: operation for water supply and operation for both water quality and water supply.
Los Vaqueros Reservoir Expansion (500,000 AF and 1,750 cubic feet per second [cfs] intake)	Reservoir expansion to 500,000 AF and 1,750 cfs intake. Multipurpose Operation evaluated as an example operation of the Los Vaqueros Reservoir Expansion.
Enhanced Conservation	
Enhanced Conservation	Includes activities not currently projected to be cost-effective within the study timeframe, including incentives for water efficient technologies⁽¹⁾. Includes opportunities for regional cooperation to increase effectiveness of certain measures (e.g., regional public outreach, regional research collaboration, regional efforts to standardize product labeling, development of a Bay Area School sponsored Conservation Calendar, and regional collaboration on Demonstration Gardens and Bay Area Landscaping Guides).
Water Recycling	
Recycled Water Concepts⁽²⁾	Twenty-six recycling projects with potential dry-year yields ranging from 20 AFY to 19,000 AFY.
Desalination	
South Bay Desalination Concepts	
• Palo Alto Water Regional Pollution Control Plant (RPCP), Palo Alto	Brackish groundwater desalination at Palo Alto RPCP in Palo Alto.
• Pico Power Plant, Santa Clara	Brackish groundwater desalination at Pico Power Plant in Santa Clara.
• Los Esteros Power Plant, San Jose	Brackish groundwater desalination at Los Esteros Power Plant in San Jose. Retained.
Regional Desalination Project (RDP)	EBMUD, CCWD, SFPUC, and SCVWD project evaluated 13 desalination sites for meeting reliability needs. Three sites selected for further evaluation in future phases of that project: Oceanside, Near Bay Bridge, Mirant Pittsburg.
Mirant Pittsburg or Antioch Desalination with Water Quality Element	Desalination at the Mirant Pittsburg or Antioch site as described in RDP, including EBMUD interconnection with and average year water quality benefit to Zone 7.
Near Bay Bridge Desalination with Water Quality Element	Desalination at the Near Bay Bridge site as described in RDP, including EBMUD interconnection with and average year water quality benefit to Zone 7.
East Bay Saline Groundwater Desalination	Saline Groundwater Desalination in Newark or Fremont connecting to ACWD's distribution system and/or SFPUC's BDPLs.
Conveyance	
Bay Area Use of the Freeport Regional Water Project	Interconnection between EBMUD and Zone 7 allowing conveyance of water through the Freeport facilities to Zone 7 for average year water quality benefits.

(1) Many of the participating agencies are already implementing water efficiency incentives, including technologies (e.g., commercial dishwashers, low flow pre-rinse spray nozzles, x-ray processor technology); education and incentives for new water efficient landscape technologies (e.g., self-adjusting evapotranspiration (ET) based sprinkler timers, drought tolerant gardening); and pricing incentives (e.g., tiered rate structures).

(2) For a description of the 26 projects, see Section 3.2.3.

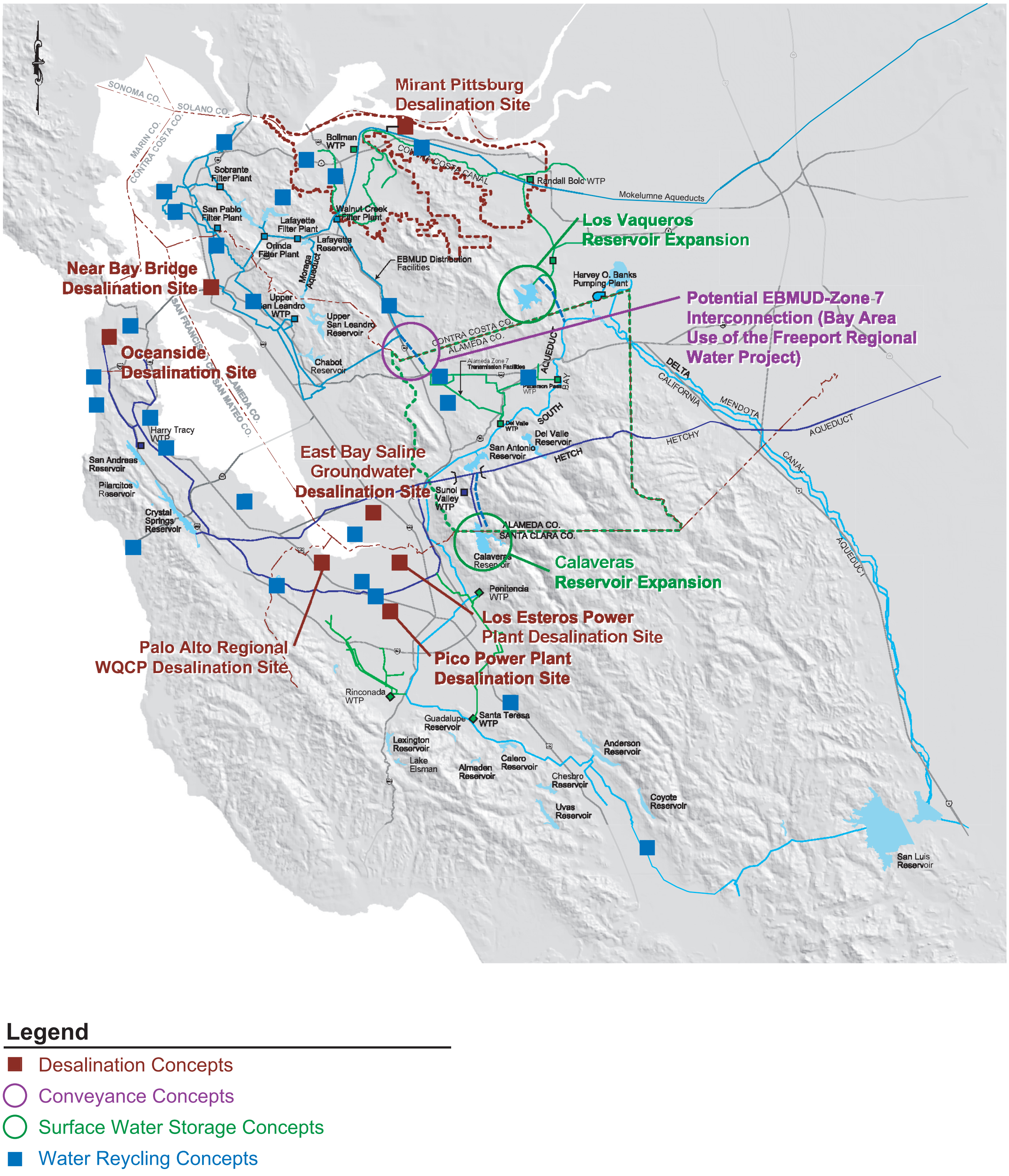


Figure ES-4

Locations of Retained Concepts

ES-3.2 Example Portfolios

Example portfolio themes were framed around the two principal goals of the Program: Maximize Water Quality and Maximize Water Supply Reliability.

- **Theme I: Maximize Water Quality:** Phase 1 of the Program found that blending of Sierra and Delta supplies alone would be insufficient to achieve the Delta source water quality targets set forth in the CALFED ROD. The fundamental limitation to blending for water quality improvements was supply quantity; it was found that there is not enough Sierra supply to dilute the parameters of concern in Delta supplies. A portfolio constructed to achieve the Maximize Water Quality theme would need to contain the maximum available supply of high quality water to achieve the maximum possible Delta water quality benefit. As a result, only one example portfolio was constructed for this theme.

- **Theme II: Maximize Water Supply Reliability:** All participating agencies, with the exception of Zone 7 Water Agency, are interested in exploring additional sources of dry year supply. The majority of the concepts retained in Phase 2 of the Program contain water supply reliability elements. However, it is unlikely that all concepts retained for detailed evaluation will proceed to implementation, due to factors such as competing budgetary considerations, overlapping distribution system capacity requirements, limitations on non-potable demand, and environmental concerns. In order to develop example portfolios catering to the variety of value systems of the stakeholders involved in the Program, and facilitate decision-making between alternatives, the fundamental theme of Maximize Water Supply Reliability was split into two subthemes, based on the types of projects incorporated. The two subthemes are: Maximize Water Supply Reliability with Storage and Maximize Water Supply Reliability without Storage. Two additional subthemes were added to illustrate the different benefits associated with each of the large reservoir expansion concepts retained for evaluation: Maximize Water Supply Reliability with Calaveras Reservoir Expansion and Maximize Water Supply Reliability with Los Vaqueros Reservoir Expansion.

Table ES-4 shows the resulting five example portfolio themes and their included concepts. Each example portfolio will benefit all participating agencies in some way or another.

TABLE ES-4. Example Portfolio Themes and Concepts Included

Concepts Included	Example Portfolios				
	Maximize Water Quality	Maximize Water Supply Reliability	Maximize Water Supply Reliability with Los Vaqueros Reservoir Expansion	Maximize Water Supply Reliability with Calaveras Reservoir Expansion	Maximize Water Supply Reliability Without Storage
Los Vaqueros Reservoir Expansion	✓	✓	✓		
Calaveras Reservoir Expansion (operate to maximize yield)		✓		✓	
Calaveras Reservoir Expansion (operate to maximize quality)	✓				
Regional Desalination Project		✓	✓	✓	✓
Mirant Desal with Water Quality Element	✓				
Near Bay Bridge Desal with Water Quality Element					
South Bay Desal		✓	✓	✓	✓
East Bay Saline Groundwater Desal		✓	✓	✓	✓
Bay Area Use of the Freeport Regional Water Project					
Current and Planned Conservation	✓	✓	✓	✓	✓
Enhanced Conservation		✓	✓	✓	✓
Water Recycling Concepts		✓	✓	✓	✓

Note: The Near Bay Bridge with Water Quality Element, Mirant Desalination with Water Quality Element, and Bay Area Use of the Freeport Regional Water Project all provide average year water quality benefits to Zone 7. However, all three concepts require the same available capacity in the Zone 7 system and could not all go forward simultaneously. The Mirant Desalination with Water Quality Element concept was selected for inclusion in the Maximize Water Quality portfolio. This concept could be replaced with either the Bay Area Use of the Freeport Regional Water Project or Near Bay Bridge with Water Quality Element concepts to obtain similar average year water quality benefits for Zone 7.

ES-4 EVALUATION OF CONCEPTS AND EXAMPLE PORTFOLIOS

The evaluation of concepts and example portfolios involves four steps:

1. Defining objectives and performance measures.
2. Identifying and developing water supply building blocks (termed project concepts).
3. Building example water quality or water supply portfolios.
4. Evaluating concepts and example portfolios.

This evaluation framework is depicted in Figure ES-5.

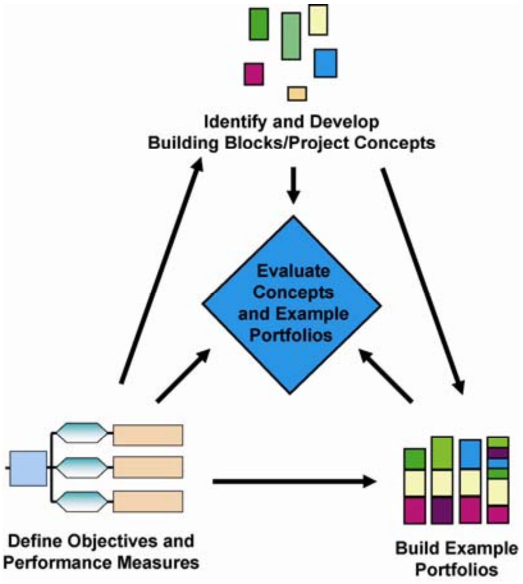

Identify and Develop
Building Blocks/Project Concepts
Evaluate Concepts and Example Portfolios
Define Objectives and Performance Measures
Build Example Portfolios

Figure ES-5
Evaluation Framework

Table ES-5 summarizes concepts evaluated in the Program and agency water supply reliability and water quality beneficiaries. Table ES-6 summarizes the example portfolios evaluated and the agency water supply reliability and water quality beneficiaries. For a summary of benefits for the concepts and example portfolios, refer to Section 4 of this document. For the comprehensive concept and example portfolio scorecards, refer to Appendix G.

TABLE ES-5. Summary of Concepts: Supply Reliability and Water Quality Yields, Potential Beneficiaries

Concept	**Type of Benefit**		**Potential Beneficiaries**													
	Dry-Year Supply (AFY)	Average Year Water Quality for Blending (AFY)	**Dry-Year Supply**							**Water Quality**						
			ACWD	BAWSCA	CCWD	EBMUD	SCVWD	SFPUC	Zone 7	ACWD	BAWSCA	CCWD	EBMUD	SCVWD	SFPUC	Zone 7
Calaveras Reservoir Expansion - water quality and supply reliability operation	Up to 41,000	Up to 50,000	✓	✓			✓	✓		✓				✓		
Calaveras Reservoir Expansion (supply reliability operation)	Up to 53,000	0	✓	✓			✓	✓								
Los Vaqueros Reservoir Expansion	52,000	121,000	✓		✓		✓			✓		✓		✓		✓
Enhanced Conservation[2]	not defined	-	✓	✓	✓	✓	✓	✓	✓							
Recycled Water[2]	Up to 92,000		✓	✓	✓	✓	✓	✓	✓							
South Bay Desalination	Up to 13,000	Up to 8,000		✓			✓	✓						✓		
Regional Desalination Project	not defined	not defined			✓	✓	✓	✓								
Mirant Desalination with Water Quality Element	not defined	Up to 15,000			✓	✓	✓	✓								✓
Near Bay Bridge Desalination with Water Quality Element	not defined	Up to 15,000			✓	✓	✓	✓								✓
East Bay Saline Groundwater Desalination	Up to 16,000	Up to 16,000	✓	✓				✓		✓						
Bay Area Use of Freeport Regional Water Project	0	Up to 16,000														✓

[1] For the purposes of this study, SFPUC includes retail customers and the 28 wholesale customers, BAWSCA member agencies.

[2] While enhanced conservation and recycled water do not provide direct water quality benefits, if additional storage is available, reduction in demand through demand management strategies such as enhanced conservation and recycled water could provide a water quality benefit by allowing agencies to preferentially use higher quality supplies.

TABLE ES-6. Summary of Portfolio Supply Reliability and Water Quality Yields and Potential Beneficiaries

Portfolio	Type of Benefit		Potential Beneficiaries													
			Dry-Year Supply							Water Quality						
	Dry-Year Supply (AFY)	Average Year Water Quality for Blending (AFY)	ACWD	BAWSCA	CCWD	EBMUD	SCVWD	SFPUC(2)	Zone 7	ACWD	BAWSCA	CCWD	EBMUD	SCVWD	SFPUC(2)	Zone 7
I: Maximize Water Quality	Up to 83,000	Up to 186,000	✓	✓	✓	✓	✓	✓		✓		✓		✓		✓
II: Maximize Water Supply Reliability	Up to 221,000	Up to 24,000	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓		✓
III: Maximize Water Supply Reliability with Los Vaqueros Reservoir Expansion	Up to 168,000	Up to 24,000	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓		✓
IV: Maximize Water Supply Reliability with Calaveras Reservoir Expansion	Up to 180,000	Up to 24,000	✓	✓	✓	✓	✓	✓	✓	✓				✓		
V: Maximize Water Supply Reliability without Storage	Up to 121,000	Up to 24,000	✓	✓	✓	✓	✓	✓	✓	✓				✓		

(1) The Near Bay Bridge with WQ Element and Bay Area Use of Freeport Regional Water Project provide average year WQ benefits to Zone 7, and use the same interconnection facilities as the Mirant Desal with WQ Element. The Mirant project is used for illustrative purposes in the example portfolios.

(2) For the purposes of this study, SFPUC includes retail customers and the 28 wholesale customers, BAWSCA member agencies.

ES-5 CONCLUSIONS/FINDINGS

As part of the detailed analysis several general conclusions have been developed. These conclusions/findings include changes since the original Phase 1 of the project, and are described in this section.

ES-5.1 Regional Approach to Addressing Water Quality and Water Supply Is Complex

A regional approach to addressing water quality and water supply is significantly more complex than considering and evaluating individual agencies' objectives and projects. This increase in difficulty is due to several factors, including: multiple partners with different interests and objectives; the challenge of keeping all interested parties involved and engaged; more constraints needing consideration; competing objectives; and conflicting time-scales.

The increased level of complexity resulted in a broadening of the original program objectives beyond those articulated in the Phase 1 work. In particular, the interplay between water quality and supply challenges became readily apparent. Agencies with water quality challenges need improvement primarily in dry years, since it is during those periods that the poorest water quality is experienced. Agencies with high quality water are all supply-limited, particularly in dry years. As a result, regional water quality opportunities are limited unless supply is also a component.

Due to the interdependent nature of the challenges facing Bay Area water systems, it became necessary in Phase 2 to develop broader and more encompassing shared objectives that expanded upon the original objective of water quality improvement, including considerations such as water supply reliability, public health protection, cost, regional control, environmental impacts and implementation potential. Performance measures were then developed to capture the degree to which the concepts and portfolios achieved these broader objectives.

As the objectives of the Program were broadened in Phase 2 to more appropriately address the complex challenges facing the Bay Area water suppliers, the scope was expanded from the original Phase I Bay Area Blending and Exchange project to include water supply alternatives. Once a comprehensive list of alternatives were developed, options were subsequently narrowed based on the agency ground rules established in the Memorandum of Understanding (Appendix A of this document):

- Alternatives must include at least two participating agencies as beneficiaries
- Alternatives must conform to institutional and/or operational constraints (e.g. water rights)
- Alternatives must maintain consistency with other ongoing studies

ES.5.2 Viable Actions Exist but there is No Simple Solution for Water Quality and Water Supply

Concepts evaluated in the study, alone or in concert, are not sufficient to achieve the numeric CALFED ROD target of 50 micrograms per liter (µg/L) bromide, and 3.0 milligrams per liter (mg/L) TOC for diverters from the Delta. Further, enhanced conservation and water recycling, while important elements of a comprehensive water quality and water supply program, are not sufficient to solve the Bay Area's water quality and water supply challenges alone.

The study underscores the need for a broad array of actions, including actions outside this study, to meet the water quality and supply reliability objectives, such as:

- Treatment optimization and improvement strategies (local)
- Implementation of specific elements of agency integrated water resource plans
- Continuation of promising regional programs (e.g., Bay Area Regional Water Recycling Program (BARWRP) and Regional Desalination Project) and supplementation with greater levels of recycling, conservation, water banking, desalination, etc, by individual agencies.
- Improvements to water quality in the Delta

ES-5.3 Improvements to Water Quality in the Delta will be Necessary to Meet the Long-Term Objectives of ELPH

The concepts alone, or even in combinations to form portfolios, cannot meet the CALFED ROD numeric target of 50 µg/L of bromide and 3.0 mg/L of TOC, indicating that improvements in Delta source water quality will be necessary to meet these long-term objectives in the ROD to provide an "Equivalent Level of Public Health" protection (ELPH), as prescribed by the CALFED Bay-Delta Public Advisory Committee (BDPAC).

The portfolio that provides the most water quality benefit is the Maximize Water Quality portfolio, which includes the Los Vaqueros Reservoir Expansion, Calaveras Reservoir Expansion operated to maximize Delta water quality, and Mirant Desalination with Water Quality Element concepts. Even with this portfolio, the CALFED ROD bromide and TOC source water quality numeric targets are not achieved. Although all participating agencies would be beneficiaries in this portfolio, the greatest water quality benefits are to the South Bay Aqueduct contractors ACWD, SCVWD, and Zone 7 Water Agency. Table ES-7 summarizes estimated bromide and TOC reductions for these agencies through implementation of this portfolio.

TABLE ES-7. Estimated Improvement in SBA Source Water TOC and Bromide Concentrations with Implementation of Maximize Water Quality Portfolio (1,2)

SBA Contractor	TOC Concentration (mg/L)		Bromide Concentration (µg/L)	
	Baseline (no portfolio)	With Maximize Water Quality Portfolio	Baseline (no portfolio)	With Maximize Water Quality Portfolio
Critical Year				
ACWD	5.1	3.0	370	80
SCVWD	5.1	3.0	370	80
Zone 7	5.1	3.6	370	160
Extended Dry Year				
ACWD	3.7	3.2	260	110
SCVWD	3.7	3.2	260	110
Zone 7	3.7	3.6	260	180
Average Year				
ACWD	4.0	3.2	190	80
SCVWD	4.0	3.2	190	80
Zone 7	4.0	3.2	190	110

(1) Concentrations are averages of monthly values for each agency and hydrology.

(2) Zone 7 water quality is not a potential partner of the Calaveras Reservoir Expansion. However, adding the Calaveras Reservoir Expansion supply in conjunction with the Los Vaqueros Reservoir Expansion allows a portion of the SBA water normally conveyed via HOB Pumping Plant to be offset by the higher quality Los Vaqueros Reservoir supplies in some months. In those months only, Zone 7 receives an indirect water quality improvement.

Capital costs cannot be developed for all of the concepts in this portfolio at this time. However, based on the planning-level capital costs that have been developed, the projected costs associated with implementation of this portfolio are projected to greatly exceed $2 billion, with operating costs in excess of $31 million per year[3]. In the context of the limited returns expected from portfolio implementation, these costs are likely to be viewed as prohibitive, and an integrated approach that combines additional improvements to source water quality in the Delta, treatment strategies, and some combination of the concepts in this study will be required to provide an equivalent level of public health protection to the numeric bromide and TOC targets in the ROD.

ES-6 AGENCY NEXT STEPS

The Program has provided a preliminarily evaluation of concepts and example portfolios in detail with respect to their performance in improving supply reliability, protecting the public health and minimizing environmental impacts for the participating agencies. The group of concepts evaluated by the Program represents a subset of the water supply reliability and water quality alternatives available to the participating agencies, with the common thread being a regional approach to water resources improvements.

The list of retained concepts is not intended to be an exhaustive list of alternatives. Further, agencies identified as potential beneficiaries of Program concepts have not committed to perform additional studies of those concepts beyond the information presented in this report, nor have they committed to implement concepts at any time in the future. It is also possible that there may be additional beneficiaries identified for project concepts as further evaluation is performed and project concepts are modified. Similarly, the example portfolios included in the Program represent five possible combinations of the concepts retained in the Program. Detailed alternatives analysis has not been performed to optimize concept combinations and achieve superior portfolios for any or all participating agencies. All participating agencies have been identified as potential beneficiaries for all portfolios; however, no agencies have committed to future studies or implementation of any or all example portfolios.

The scorecards developed for the Program are intended to provide the participating agencies with quantitative and qualitative information to aid decision-making processes. Each participating agency has water supply reliability and water quality challenges unique to that agency. As such, each participating agency has unique priorities for developing water resources strategies, and a specific system for deciding between competing water resources alternatives. The information provided in the scorecards should be used by each agency to determine whether a given concept or example portfolio merits further attention and study by the agency. Determinations of what concepts and example portfolios are most beneficial will be left to the individual participating agencies, to be informed by the analysis developed in the Program.

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[3] CALFED Los Vaqueros Expansion Studies (CALFED, 2004) project capital costs of $1,514 million and operating costs of $27.5 million ($2008). Capital, operating, and life-cycle costs for RDP elements to be determined as part of RDP. Conceptual-level Zone 7 intertie costs are estimated at $24 million ($2005). Operational costs for the Mirant Desalination with Water Quality Element concept have not been estimated. Zone 7 life-cycle costs would need to consider capital, operating and potential buy-in/wheeling fees. Calaveras capital costs are estimated at $426 million ($2003), with operating costs estimated as $3.5 million per year ($2004). Capital costs for the Calaveras Reservoir Expansion include new dam, spillway, outlet works (Contingency Action Plan for Calaveras Dam Evaluations, URS, 01/2003), pipelines from reservoir to SVWTP, from SVWTP to pump station and from Calaveras to SBA, pump station, power, pressure reducing station. Pumping costs estimated as $3.5 million/year. Operating costs and annualized costs associated with the Calaveras Reservoir Expansion concept to be determined as part of future SFPUC studies.

This study was conducted at a pre-feasibility level to determine which, if any, concepts considered merit further attention by some or all participating agencies. The analysis contained in this document and its appendices is similarly at a pre-feasibility level, and is not intended to be a comprehensive water quality and/or supply reliability analysis. Upon deciding that concept(s) and/or portfolio(s) merit additional study, detailed analysis will still need to be performed by the interested agencies. The additional steps to concept and/or portfolio evaluation that may potentially be pursued by participating agencies are described below.

If the concept or example portfolio is considered to merit additional study:

- Additional conceptual-level engineering evaluations, including assessment of facility alternatives, costs and refinement of water quality and supply reliability benefits using detailed water supply and water quality modeling consistent with each agency’s internal modeling;

- Detailed environmental impact assessments, including EIR/EIS development;

- Institutional and financial analysis to identify possible institutional structures for implementation, cost-sharing and funding options, and associated participating agency costs and benefits.

If the concept or example portfolio is not considered to merit additional study:

- No additional analysis will be pursued and the concept or example portfolio will not advance.

Section 1
Introduction

Section 1
Introduction

1.1 OVERVIEW OF PROGRAM

The Bay Area Water Quality and Supply Reliability Program (Program) was established to identify regional opportunities for enhancing water supply and/or water quality for Bay Area agencies. The program, initially identified in the CALFED Bay-Delta Program (CALFED) environmental review process, and outlined in the CALFED Record of Decision (ROD) for the Final Programmatic Environmental Impact Statement and Environmental Impact Report (EIS/EIR) (CALFED, 2000), provides for Bay Area agencies to work cooperatively to address water quality and supply reliability concerns on a regionally focused basis. The Program, initially identified as the Bay Area Blending/Exchange (BAB/E) Project, was re-named to the Bay Area Water Quality and Supply Reliability Program (BAWQ&SRP) at the outset of Phase 2. The Program is considered a complementary action to the CALFED Bay-Delta Program. As such, the Program, though not evaluated in the Final Programmatic EIS/EIR, would help to achieve objectives for water quality and water supply reliability consistent with Bay-Delta Program framework established in the CALFED ROD.

Bay Area Water Quality and Supply Reliability Program Participants

- Alameda County Water District (ACWD)
- Bay Area Water Supply and Conservation Agency (BAWSCA)
- Contra Costa Water District (CCWD)
- East Bay Municipal Utility District (EBMUD)
- San Francisco Public Utilities Commission (SFPUC)
- Santa Clara Valley Water District (SCVWD)
- Zone 7 of Alameda County Flood Control and Water Conservation District (Zone 7 Water Agency)

1.1.1 Phase 1

Phase 1 of the program was initiated prior to the ROD in 2000 and completed in 2001. The purpose of Phase 1 of the Bay Area Blending/Exchange study was to perform a preliminary investigation of the potential for blending higher quality water (i.e., Sierra runoff) through the use of existing and/or additional conveyance and storage infrastructure to improve water quality of Delta water imports. The study was completed in four tasks. The first task quantitatively assessed individual water suppliers' needs for higher quality water as compared to CALFED water quality objectives/targets for bromide equal to or less than 50 micrograms per liter (µg/L) and total organic carbon (TOC) less than 3 milligrams per liter (mg/L), or an equivalent level of public health protection (ELPH). The second task summarized existing and projected water demands. The third task summarized existing conveyance and storage facilities. The final task compared the potential available conveyance and storage capacity with blending water needs and patterns and described potential capital projects. According to the results from Phase 1, in order to meet the numeric objectives/targets just through a blending approach at current demand, approximately 350,000 acre-feet of "Sierra" quality water would be required in an average or dry year, and approximately 300,000 acre-feet (AF) would be required in a wet year. These amounts would increase by approximately 15 to 25 percent at build-out for all agencies' diversions. In Phase 1, it did not appear that there was sufficient hydraulic or hydrologic capacity currently in the Sierra systems to provide this amount of water. By comparison, the current Sierra water delivery to the Bay Area is approximately 660,000 acre-feet per year (AFY). Despite the lack of Sierra system capacity to meet blending needs, a list of potential projects providing an incremental water quality and supply reliability benefits was developed for evaluation in Phase 2.

As the Bay Delta Public Advisory Committee Drinking Water Quality Subcommittee has developed its strategic plan, it has developed a drinking water quality improvement strategy (Figure 1-1) showing the water management actions and studies that can be followed to achieve the CALFED ROD water quality objectives. This was further developed into a diagram showing the program approach to achieving drinking water quality targets known as the ELPH diagram (Figure 1-2). Both Phase 1 and 2 of this program have been evaluating a portion of the tools from the Drinking Water Quality Improvement Strategy.

1.1.2 Program Guiding Principles

At the beginning of Phase 2, in the summer of 2001, participating agencies, along with State and Federal agencies, including California Department of Water Resources, California Department of Health Services, U.S. Bureau of Reclamation, and the U.S. Environmental Protection Agency, signed a Memorandum of Understanding (MOU). The purpose of the MOU was to memorialize the mutual willingness of the parties to share information and work cooperatively to address water quality and supply reliability concerns. The MOU outlined three guiding principles, summarized in Table 1-1. A copy of the complete MOU is included in Appendix A.

TABLE 1-1. Guiding Principles of Bay Area Water Quality and Supply Reliability Program from Memorandum of Understanding

- Agencies have different water sources and different water supply and quality concerns, as well as independent programs to address these concerns.
- To encourage a regional approach, the Program will evaluate a range of options, including changes to infrastructure and institutional arrangements.
- Local agencies will continue to independently develop storage and other projects to meet local needs.

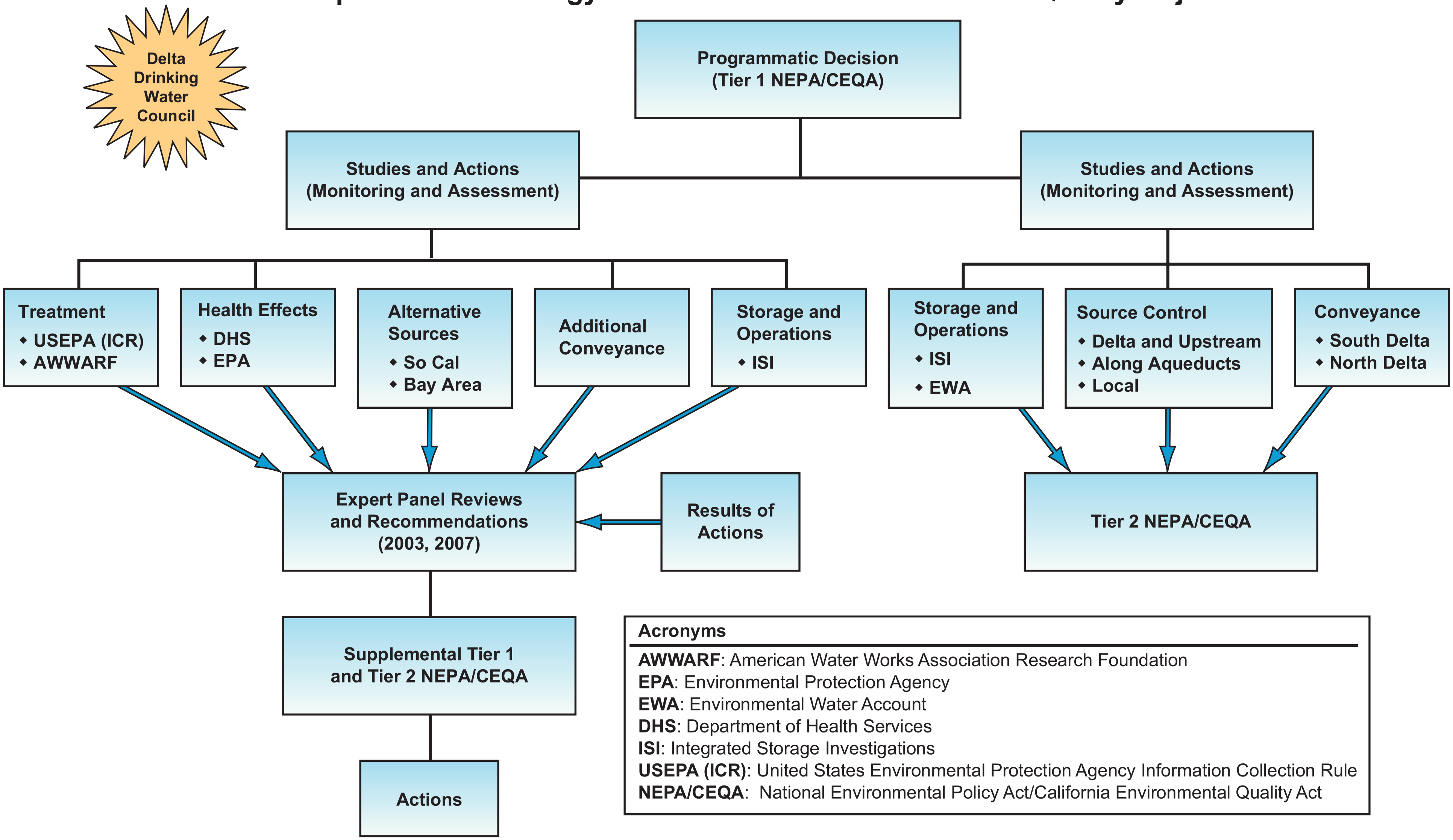
1.1.3 Program Phases and Milestones

Phase 2 of the Program has concluded, in what was planned as a four phase program:

- **Phase 1 – Initial Assessment**: Compiled water quality, demand and system data for participating agencies and formulate preliminary list of concepts;
- **Phase 2 – Feasibility Studies:** Evaluated and developed concepts; grouped concepts into sample portfolios; screened concepts and sample portfolios;
- **Phase 3 & 4 – Detailed Evaluation:** Project selection and development, environmental review, financing, implementation plan, design and operations plan.

Phase 1 and 2 of the Program were funded by CALFED. To date, neither State nor CALFED funding for phases 3 and 4 has been authorized. Because of uncertain funding for future Program phases, Phase 2 developed concept information for participating agencies to use, as they go through their own respective decision-making processes to determine whether to pursue concept implementation.

Bay-Delta Public Advisory Committee Drinking Water Quality Improvement Strategy to Achieve CALFED ROD Water Quality Objectives



Acronyms

AWWARF: American Water Works Association Research Foundation
EPA: Environmental Protection Agency
EWA: Environmental Water Account
DHS: Department of Health Services
ISI: Integrated Storage Investigations
USEPA (ICR): United States Environmental Protection Agency Information Collection Rule
NEPA/CEQA: National Environmental Policy Act/California Environmental Quality Act

Figure 1-1
Bay-Delta Public Advisory Committee Drinking Water Quality
Improvement Strategy to Achieve CALFED ROD Water Quality Objectives

CDM

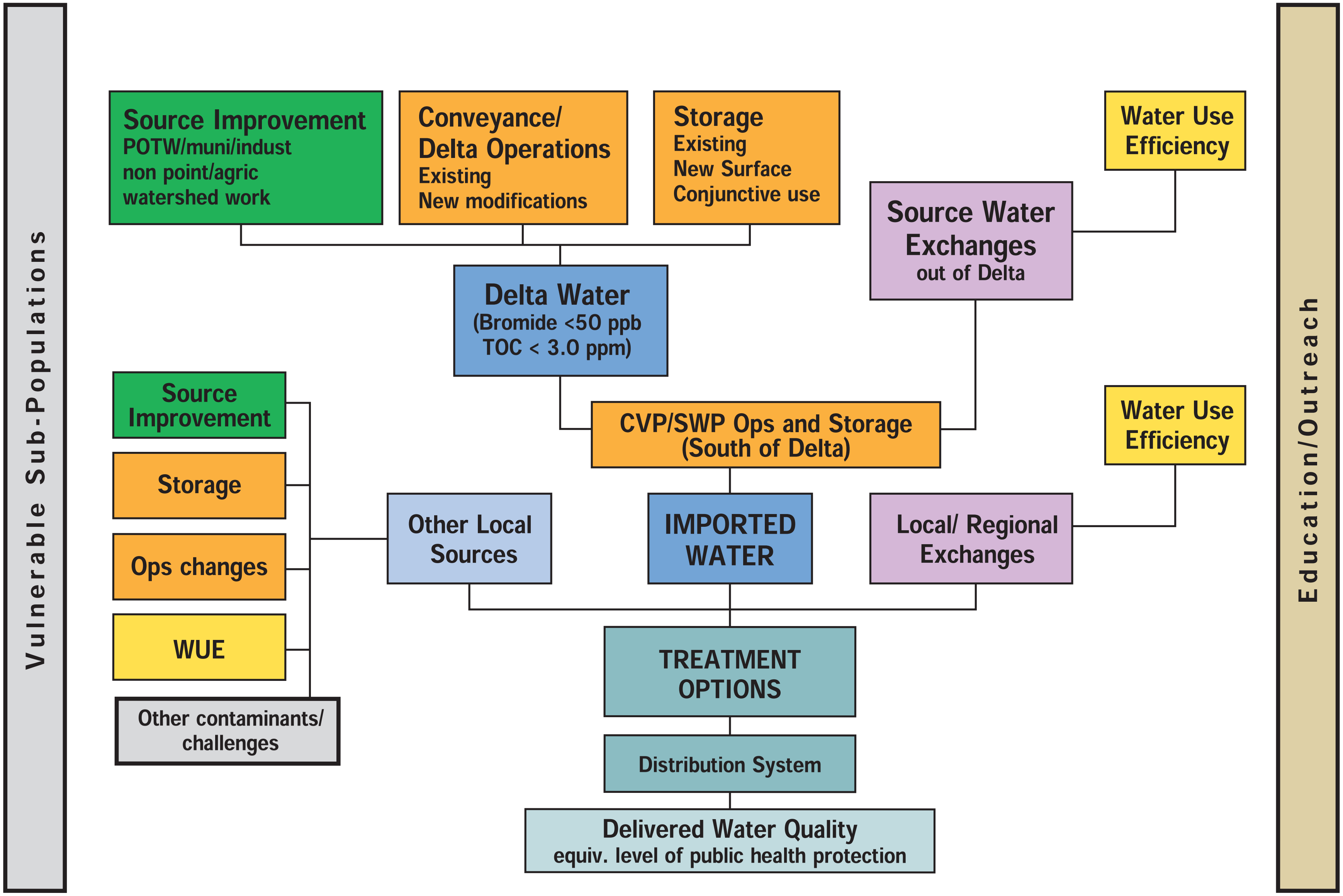


Figure 1-2
Bay-Delta Public Advisory Committee
Equivalent Level of Public Health Protection Decision Tree

Figure 1-3 summarizes key Program milestones, to date.

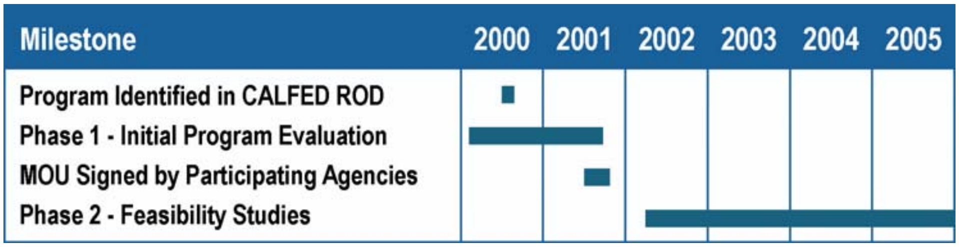


Figure 1-3
Key Milestones

1.2 INTERRELATIONSHIP TO OTHER PROGRAMS AND ORGANIZATIONS

The Program is one of several efforts underway to address regional water supply reliability and water quality issues. This section describes some of these other efforts and their relationship to the Program.

1.2.1 Bay Area Water Agencies Coalition

In 2002, the seven Bay Area agencies participating in the Program formed a regional forum, the Bay Area Water Agencies Coalition (BAWAC), to provide a unified voice in resolving the region's water quality and supply reliability challenges. General managers of each of the participating agencies meet bi-monthly to address regional water quality and water supply issues.

One of BAWAC's initial tasks was to develop, through a series of workshops, regional objectives to be used in the evaluation process for Phase 2 of this Program (See Section 1.5). Other BAWAC activities have included preparing a summary of water conservation programs in the Bay Area, preparing a summary of other water management tools (e.g., water recycling, groundwater banking, water transfers, etc.), and initiating preparation of a Bay Area Integrated Regional Water Management Program.

The technical team has provided periodic briefings to present results from the Program and seek input from BAWAC.

1.2.2 Integrated Regional Water Management Plan

Bay Area water related agencies are collaboratively working together with ABAG, Sanitation & Flood Control Agency, and the Coastal Conservancy to develop an Integrated Regional Water Management Plan (IRWMP) for the San Francisco Bay Area. Plan participants include water, wastewater and stormwater management agencies from the nine Bay Area counties, the Association of Bay Area Governments, and the Coastal Conservancy. The IRWMP aims to facilitate regional cooperation in the following areas:

- Water Supply Reliability
- Water Recycling
- Water Conservation
- Water Quality Improvements
- Stormwater Capture and Management
- Flood Management
- Recreation and Access
- Wetlands Enhancement and Creation
- Environmental Habitat Protection and Improvement

The Bay Area IRWMP covers all nine counties of the San Francisco Bay Area and is divided into four main chapters: (1) Water Supply and Water Quality, (2) Wastewater and Water Recycling, (3) Watershed Planning, and (4) Flood Control and Stormwater.

The Water Supply and Water Quality chapter specifically compiles existing information from the Bay Area agencies, identifies challenges with respect to water supply and water quality, and describes various approaches to addressing those challenges. The chapter was written with the cooperation of eleven Bay Area water agencies. The BAWAC group has taken a leadership role in developing the chapter and coordinating the incorporation of the other three chapters into the overall Bay Area IRWMP.

The Water Supply and Water Quality chapter shares important linkages with the Bay Area Water Quality and Supply Reliability Program. Both documents aim to address the same objectives. These include: maximizing supply reliability, maximizing public health protection, minimizing cost impacts, minimizing environmental impacts, and maximizing implementation potential. To meet these objectives the IRWMP establishes a regional framework of collaborative planning and project coordination among Bay Area agencies. The primary distinction between the two efforts is that the IRWMP lays out the current water facilities/management master planning for the agencies, while the Program explores alternatives that might be done among regional agencies beyond their current respective planning programs.

While inclusion or exclusion of a concept from the Bay Area Water Quality and Supply Reliability Program is not intended to confer any status or preference for the alternatives evaluation process in the Integrated Regional Water Management Plan, the IRWMP increases the potential for securing funding and the possibility of implementing specific concepts identified in the Program.

1.2.3 Bay Area Regional Desalination Project

East Bay Municipal Utility District, San Francisco Public Utilities Commission, Contra Costa Water District and Santa Clara Valley Water District are jointly exploring developing regional desalination facilities that could benefit Bay Area residents and businesses served by these agencies. The Bay Area Regional Desalination Project (RDP) is evaluating one or more desalination facilities, with a capacity of up to 120 million gallons per day. The project would provide emergency and drought supply, as well as allow maintenance of major facilities, and provide full-time supplemental water to increase agencies' water supply portfolios.

In October 2003, the regional partner agencies completed a Phase 1 Pre-feasibility Study. The study identified three potential sites for a project: Mirant Pittsburg power plant site, in Pittsburg, near the Bay Bridge in Oakland, and near Oceanside wastewater treatment plant in San Francisco. More detailed feasibility and environmental studies will be conducted to provide more information on potential benefits, location and type of facilities, environmental impacts and costs.

The Regional Desalination Project is one of the concepts being evaluated in the Bay Area Water Quality and Supply Reliability Program. At the request of the partner agencies, all of whom are participants in the Program, information on this concept is limited to that developed for the Phase 1 Pre-feasibility Study.

1.2.4 Bay Area Regional Water Recycling Program

The Bay Area Regional Water Recycling Program (BARWRP) was originally formed in the late 1990's as part of a regional master planning effort dedicated to promoting beneficial water recycling in the Bay Area. BARWRP is a partnership of over thirty San Francisco Bay Area water and wastewater agencies, the California Department of Water Resources (DWR), and the U.S. Bureau of Reclamation (USBR). In 1999 BARWRP completed a comprehensive Regional Water Recycling Master Plan to assess the future feasibility of water recycling in the Bay Area. The Plan identified a recycled water market potential of over 125,000 acre-feet per year by 2020 and developed new methodologies and tools to develop, screen, evaluate, and implement recycled water projects from a regional perspective. The 1999 projections were based on existing recycled water projects, future agency recycled water master plans and the Association of Bay Area Governments (ABAG) land use projections in correlation with standard recycled water use rates.

Recently BARWRP has been meeting to discuss the future of regional water recycling in the Bay Area. To this regard, BARWRP approved a Work Plan primarily focused on updating the 1999 Master Plan Executive Summary, pursuing key funding opportunities, such as the 2004 CALFED Authorization (PL 108-361), and conducting a stakeholder workshop to discuss "lessons learned" from recycled water projects. Updating the 1999 Master Plan is of particular importance because overcoming recycled water challenges, which include institutional barriers, funding constraints, stringent regulations for environmental use, and public concern, will require a regional effort. By expanding its scope and membership to include North Bay agencies and utilizing the knowledge gained since the 1999 Master Plan, BARWRP is positioning itself to advance regional recycled water efforts in the Bay Area.

1.2.5 CALFED Los Vaqueros Reservoir Expansion Studies

The CALFED Bay-Delta Program is evaluating the need for additional surface water storage as an important activity to improve water quality and water supply reliability. One project identified in the CALFED ROD is the potential expansion of Los Vaqueros Reservoir in Contra Costa County.

The CALFED Los Vaqueros Expansion Studies are examining the feasibility of expanding the existing reservoir to help meet CALFED objectives and serve the water quality and water reliability needs of the Bay Area. The USBR, the California DWR, and CCWD are jointly responsible for completing and managing the CALFED Los Vaqueros Reservoir Expansion Studies.

To date, many technical and environmental studies have been completed. In March 2004, voters in the CCWD service area passed an advisory vote to allow environmental and engineering studies of the potential reservoir expansion to continue. In early 2005, public scoping meetings will be held to provide opportunities for all interested stakeholders to comment on the scope of the environmental studies.

Los Vaqueros Reservoir Expansion is one of the concepts being evaluated in the Bay Area Water Quality and Supply Reliability Program. Information presented on this concept is based on technical information provided by the Los Vaqueros Reservoir Expansion studies team.

1.2.6 CALFED Water Use Efficiency Element

The CALFED Water Use Efficiency (WUE) Element is one of the fundamental elements of CALFED's water management strategy. It involves an aggressive approach to water management, consisting of agricultural, urban, water recycling and managed refuges components. The WUE Program Implementation Plan cites the goal of the WUE Element as "…develop(ing) a set of programs and assurances that contribute to CALFED goals and objectives, has broad stakeholder acceptance, fosters efficient water use, and helps support a sustainable economy and ecosystem. The goals of the WUE Element will be met by providing tools to local water suppliers and water users to improve water use efficiency. These tools include financial and technical assistance, research, and assurances."

Among the WUE Program tasks is a comprehensive evaluation of the WUE Program's first 4 years. Based on this evaluation, CALFED will make appropriate additional State and Federal investments and actions to assure continued aggressive implementation of water use efficiency measures in the State.

At the beginning of Phase 2, Environmental Defense requested three specific concepts be included in Phase 2 of the BAWQ&SRP: demand management and reclamation above what was locally cost effective for each agency, tiered pricing, and exchanges with water users on the Tuolumne and Mokelumne systems, including quantification of benefits[1]. Reclamation above what was considered cost-effective and quantification of benefits was included in the Water Recycling concepts, and is described later in this report. Conservation above what was considered cost-effective has been incorporated into the Enhanced Conservation concept. Quantification of future conservation-related water savings was specifically the charge of the WUE 4-year evaluation. If both studies were to pursue quantification, reconciling the differences in the assumptions and analysis between the two studies would be counterproductive. To minimize confusion for the public and agencies, and to maximize cost-effectiveness, quantification of possible future savings was deferred to the WUE 4-year evaluation and to each agency's water conservation planning.

In addition, the water that could be developed using a tiered pricing structure is generally the same water that could be estimated to be conserved using various water saving appliances or landscaping changes. Consistent with the WUE 4-year evaluation, tiered pricing was not examined as a separate concept but was considered to be a tool that local agencies could use to implement water conservation measures.

In the Mokelumne and Tuolumne drainages, a large percentage of applied water generally returns to the rivers and could not be transferred without affecting downstream diverters. The smaller percentage of applied water cost to evaporation/transpiration is the only component available for transfer. While conservation in these areas could potentially be justified based on local environmental and other quantifiable objectives, the potential benefit associated with out-of-basin transfers was considered too small when considered in the context of the numerous institutional obstacles that exist, such as local opposition and legal constraints. Additional water conservation in these areas was left to the local agencies to implement as part of the WUE Program element.

If the WUE 4-year evaluation is not complete before the completion of Phase 2 of the Program, the quantification effort can be appended to the report at a later date and addressed by member agencies at that time.

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[1] Concepts were identified by Marguerite Young of Clean Water Action and Spreck Rosekrans of Environmental Defense in a letter dated November 14, 2001.

1.2.7 Calaveras Reservoir Expansion Project

A San Francisco Public Utilities Commission (SFPUC) study is currently looking at alternatives for replacement of the Calaveras Dam, which is operating under restrictions by the California Division of Safety of Dams, due to potential seismic concerns. The SFPUC is evaluating replacing the reservoir at its existing capacity, and replacing the reservoir with the ability to expand it in the future.

A regional partnership to expand Calaveras Reservoir is one of the concepts being evaluated in the Bay Area Water Quality and Supply Reliability Program. The regional concept and operational scenarios presented in the program are based on concept-level planning studies for the Calaveras Reservoir expansion. They are presented for illustrative purposes to evaluate potential water supply and water quality benefits, but do not represent a future operating scenario endorsed by the SFPUC nor do they represent a complete characterization of all facilities that may be required for the project.

1.2.8 Freeport Regional Water Project

EBMUD and Sacramento County Water Agency (SCWA) have formed a Joint Powers Authority called the Freeport Regional Water Authority (FRWA) to implement the Freeport Regional Water Project (FRWP). The project would provide dry-year supply for EBMUD from a new diversion located on the Sacramento River near Freeport. New pipelines would convey water from the Sacramento River to the Folsom South Canal, and from the canal to the Mokelumne Aqueduct. The Final Environmental Impact Report for the Freeport Project was released in March 2004 and certified in April 2004. The Environmental Impact Statement was certified in January of 2005.

EBMUD would operate Freeport project facilities only in years when its projected total system storage falls below target levels, to reduce drought impacts to customers. In average and wet years, conveyance facilities could potentially be used by others. The Bay Area Regional Water Quality and Supply Reliability Program is evaluating potential use of Freeport facilities during average and wet years to convey water to other interested Bay Area water agencies. Additional environmental documentation will be required to utilize this potential.

1.2.9 The Northern California Salinity Coalition

The Northern California Salinity Coalition was created in 2003 to advance the interests of its ten[2] member agencies in the development of local and regional projects and programs that will use desalination and salinity management technologies, practices, and approaches to improve water supply reliability for Coalition members and to reduce salinity-related problems affecting the water supplies of member agencies. The water agencies involved in the Program are all members of the coalition, with the exception of BAWSCA. Some of the project concepts evaluated in the Program may be considered by the Salinity Coalition.

1.3 OUTREACH EFFORTS

In addition to coordinating with the other studies and efforts described above, part of the Program included outreach with a number of organizations, including briefings to the BAWAC general managers, the California Bay Delta Public Advisory Committee Drinking Water Subcommittee, business groups, and environmental stakeholder groups and others. Input from the environmental stakeholders on objectives and performance measures was provided through a series of meetings. Environmental stakeholders also provided suggestions on project alternatives to be included in Phase 2. Some of these were included in the analysis but others were dropped as explained in later sections.

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[2] Originally consisted of eight members (ACWD, CCWD, EBMUD, SFPUC, SCVWD, Solano County Water Agency, Sonoma County Water Agency, Zone 7 Water Agency), but expanded to ten with the inclusion of Marin Municipal and Delta Diablo Sanitary District.

1.4 PHASE 2 SCOPE OF WORK

The purpose of Phase 2 of the Program is to evaluate and develop concepts and to identify regional opportunities for enhancing water supply and water quality. Key tasks for the Phase 2 effort are summarized in Table 1-2.

TABLE 1-2. Summary of Key Tasks and Work Elements for the Bay Area Water Quality and Supply Reliability Program

Task	*Objective*	*Work Elements*	*Discussed in*
1: Refine Objectives	Develop and refine objectives for Phase 2 evaluations	• Develop objectives based on stakeholder involvement • Organize and categorize objectives into primary and sub-objectives • Develop appropriate measurement criteria.	Section 1.5, Appendix F
2: Develop and Coordinate Planning Assumptions	Develop assumptions for future water supply and water quality conditions for use in concept analysis	• Review CALFED and relevant partner planning documents • Prepare technical memorandum summarizing supply and water quality baseline information	Section 2, Appendix B (Demands) Appendix C (Supplies and Water Quality) Appendix D (Water Treatment)
3: Develop Evaluation Framework	Establish framework for evaluating concepts and portfolios	• Refine performance measures • Develop evaluation methods • Develop analysis reporting formats	Sections 1.5, 4.1
4: Develop Concepts and Portfolios	From concepts, develop example portfolios	• Develop preliminary information on concepts identified in Phase 1 • Evaluate concepts for consistency with project goals and objectives • Prepare technical memorandum describing concepts and portfolios	Section 3.1, 3.2
5: Concept and Portfolio Descriptions	Develop concept descriptions and evaluate concepts and portfolios	• Conduct environmental and engineering analysis to develop concepts to a similar level of detail • Document findings in technical memorandum	Section 3.3 Appendix E
6: Concept Evaluations	Analyze concepts and portfolios to allow stakeholders to identify concepts or portfolios to pursue further	• Quantify water quality impacts and benefits of concepts and portfolios • Quantify water supply reliability of concepts • Develop preliminary planning-level economic analysis	Section 4.2 Appendix G
7: Outreach and coordination	Identify and engage affected parties not directly involved in project	• Identify key stakeholder groups • Prepare quarterly updates • Conduct briefings/presentations	Section 1
8: Integration with other CALFED Regional Implementation Plans	Provide technical information and analysis to assist CALFED staff who will integrate several programs	• Provide information and analysis to CALFED staff integrating the overall CALFED water management activities.	Section 1

Because of the number of Program agency participants, each with unique water sources, water quality and supply goals, Phase 2 relied heavily on a facilitated stakeholder process, with regular workshops to exchange information, receive input from water agency staff, and discuss and resolve areas of disagreement. Table 1-3 summarizes workshop topics, held at key points during the project.

TABLE 1-3. Summary of Workshop Topics for the Bay Area Water Quality and Supply Reliability Program

- Objectives and Performance Measures (Two workshops held with BAWAC, one with Program agency representatives)
- Decision-making Framework
- Data Issues, Uncertainties and Intended Data Uses
- Baseline Information Needs and Presentation
- Concept Review and Confirmation
- Portfolio Formulation
- Analysis Process
- Analysis Results and Scorecard Review

1.5 PROGRAM OBJECTIVES AND PERFORMANCE MEASURES

The Bay Area Water Quality and Supply Reliability Program seeks to identify regional opportunities for enhancing each Bay Area water agency's water resources. Developing clear objectives (i.e., the fundamental end to be achieved) is an essential step for this program. Objectives used in the evaluation process should be:

- **Measurable.** The degree to which an alternative or project can achieve an objective should be measurable.

- **Non-Redundant.** There should be no overlap between the objectives.

- **Concise.** The number of objectives should be kept manageable, especially primary objectives.

- **Understandable.** Objectives should be easily explainable to policy makers and the public.

These objectives and their associated performance measures (i.e., the metrics which indicate the degree to which the objectives are being realized) form the basis for the analysis of the various regional options. These options may consist of single concepts, or several concepts bundled into portfolios.

The evaluation of concepts and example portfolios involves four steps:

1. Defining objectives and performance measures.
2. Identifying and developing water supply building blocks (termed project concepts).
3. Building example water quality or water supply portfolios.
4. Evaluating concepts and example portfolios.

This evaluation framework is depicted in Figure 1-4.

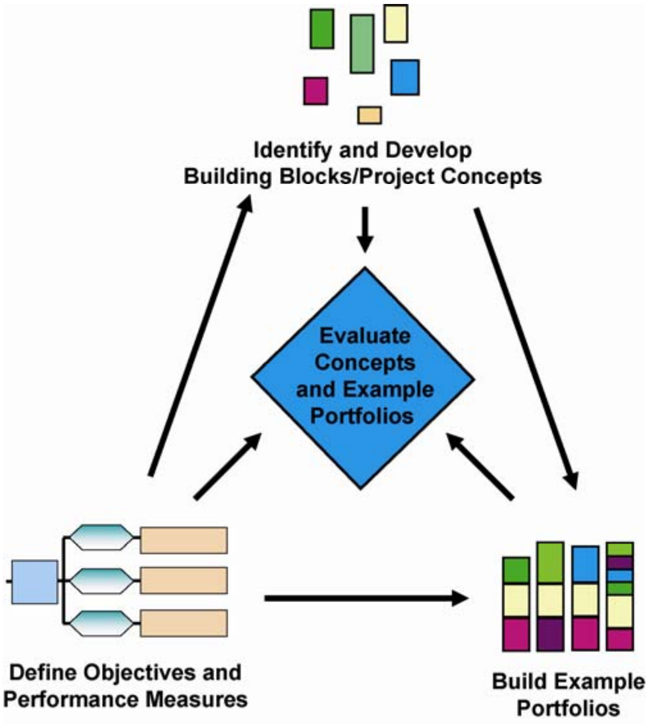
Identify and Develop
Building Blocks/Project Concepts
Evaluate Concepts and Example Portfolios
Define Objectives and Performance Measures
Build Example Portfolios

Figure 1-4
Evaluation Framework

In measuring the performance of a broad range of water resource options against the planning objectives, different concept combinations will be explored, and various water resource strategies identified. The details of how concepts and portfolios were evaluated, what tools and metrics were used in the evaluation, and how the data was presented, are outlined in the following sections. For additional information, please refer to Appendix F of this document.

Although there are many analytical approaches that can be used to aid decision-making, the one common element that exists in virtually all approaches is the need to identify objectives that are not organizationally based, but project based. Objectives can be expressed at various levels of detail starting at the most fundamental (primary) and working down to the more specific. Primary objectives help an organization communicate its purpose to policy makers, governing boards, and the public. For example, the specific objective "ensuring adequate water recycling" may not adequately convey a public call to action, while the broad primary objective of "protecting the environment" would.

Performance measures are the specific metrics or measures to evaluate how well objectives are met. In separate efforts, the Bay Area Water Agency Coalition developed objectives and performance measures for this project. These objectives and performance measures were also reviewed with the individual participating agencies. The environmental water caucus and environmental stakeholder representatives have also developed preliminary objectives and performance measures which further expand upon the environmental objectives developed by BAWAC.

The BAWAC group met in two workshops with follow-up comments provided by the participants. Five primary objectives were identified to express the shared mission of the participating agencies. These five objectives are:

1. Supply Reliability
2. Public Health Protection
3. Cost Impacts
4. Environmental Impacts
5. Implementation Potential

Within each of these primary objectives, a set of more detailed secondary objectives was developed. Substantial input was provided by technical support staff from BAWAC member agencies in the development and wording of these sub-objectives. Table 1-4 reflects the final list of primary and secondary objectives.

TABLE 1-4. Shared Objectives and Performance Measures from Bay Area Water Agency Coalition (BAWAC)(1)

Objective and Sub-Objective	*Local Agency Perspective Performance Measure*	*Regional Perspective Performance Measure*	*Data Inputs*
Supply Reliability			
Meet Demands	Mixed qualitative and quantitative description as to incremental supply as compared to demand.	Mixed qualitative and quantitative description as to incremental supply as compared to demand, the population base affected and the number of agencies receiving benefits.	1. Baseline demands for each agency (wet, normal, dry). 2. Incremental supply yield from portfolio by agency (wet, normal, dry). 3. Population base per agency.
Vulnerability	Narrative description as to the relative amount of supply dependent on common hydrology/infrastructure for region.	Degree to which vulnerability is decreased, the population base affected and the number of agencies receiving benefits.	1. Sources of where new supply originates. 2. Major conveyance systems used by agencies to transport water. 3. Major treatment facilities.
Control within the Region	Degree of dependency on state and federal control of projects and involvement of other beneficiaries (e.g., Environmental Water Account).		1. Who constructs/operates portfolios? 2. Are portfolios to be used for other beneficiaries outside region?
Public Health Protection			
Disinfection By-Products (DBPs)	Projected levels of DBPs in delivery water compared to baseline.	Level of reduction in DBPs in delivery water as compared to baseline, the population base affected, and the number of agencies receiving benefits.	1. Levels of TOC and bromide in source water. 2. Current/planned treatment processes for each agency.
Total Dissolved Solids (TDS)	Projected levels of TDS in delivery water compared to baseline.	Projected reductions in TDS as compared to baseline, the population base affected, and the number of agencies receiving benefits.	1. Levels of TDS in existing and new source waters. 2. Current/planned treatment processes for each agency.
Variability for Treatment	Degree of variability in source water and implications for treatment.	Reduction in variability as compared to baseline, the population base affected, and the number of agencies receiving benefits.	1. pH changes of source water. 2. Temperature changes of source water.
Taste and Odor Problems	Incidence of taste and odor problems.	Reduction in taste and odor problems as compared to baseline, the population base affected, and the number of agencies receiving benefits.	1. Source of water (Delta, reservoir, treatment process). 2. Susceptibility of source to algal blooms. 3. TDS of source water.
Cost Impacts			
Total Cost	Projected total lifecycle cost (both capital and O&M over life of projects).		1. Capital cost, financed over life of portfolio. 2. Operating and maintenance (O&M) cost (non-escalated). 3. Environmental mitigation costs (if any). 4. Assumed finance rate.
Allocation of Costs	Narrative outlining the degree to which benefits (e.g., water yield, water quality, etc.) and cost are balanced for involved agencies.		1. Total lifecycle cost for each agency. 2. Total new water yield for each agency.

TABLE 1-4. Shared Objectives and Performance Measures from Bay Area Water Agency Coalition (BAWAC)(1)

<table>
<tr><th>Objective and Sub-Objective</th><th>Local Agency Perspective Performance Measure</th><th>Regional Perspective Performance Measure</th><th>Data Inputs</th></tr>
<tr><td colspan="4">Potential Environmental Impacts(2)</td></tr>
<tr><td>Overall Impacts to Environment</td><td colspan="2">Projected overall impacts (e.g., from impacts to sensitive aquatic, terrestrial, and wetland resources, and special-status species, as well as increases in energy consumption and pollutant emissions).</td><td>1. Qualitative assessment of overall environmental impacts, before and after mitigation has been factored in.</td></tr>
<tr><td>Overall Benefits to Environment</td><td colspan="2">Narrative description of projected overall benefits to the natural environment, including benefits to Delta resources.</td><td>1. Qualitative assessment of overall environmental benefits, before and after mitigation has been factored in.</td></tr>
<tr><td>Aquatic Environment</td><td colspan="2">Qualitative assessment of potential impacts to the aquatic environment .</td><td>1. Potential for temporary construction and long-term operation effects to aquatic resources.
2. Benefits, if any, to aquatic resources from offset of pumping at the Delta.</td></tr>
<tr><td>Terrestrial Environment</td><td colspan="2">Qualitative assessment of potential Impacts to the terrestrial environment (acreage affected).</td><td>1. Potential for temporary construction effects to terrestrial resources (e.g., habitats).
2. Potential long-term removal or loss of terrestrial resources (e.g., habitats) from facilities siting.</td></tr>
<tr><td>Wetlands</td><td colspan="2">Qualitative assessment of potential effects to wetland resources (acreage affected).</td><td>1. Potential for temporary construction effects to wetland resources (e.g., wetlands, vernal pools).
2. Potential for long-term removal or loss of wetland resources (e.g., wetlands, vernal pools) from facilities siting.</td></tr>
<tr><td>Special Status Species</td><td colspan="2">Qualitative assessment of potential impacts to special-status species (number of species).</td><td>1. Temporary construction or long-term operation effects to special-status plant and wildlife species.</td></tr>
<tr><td rowspan="2">Energy Consumption</td><td colspan="2">Qualitative assessment of potential increase in energy consumption required for facility operation.</td><td>1. Energy consumption associated with facility operation, considering energy recovery and pumping offsets.</td></tr>
<tr><td colspan="2">Qualitative assessment of potential increase in criteria pollutant emissions.</td><td>2. Potential for increase in SOX, NOX, reactive organic gases (ROG), and carbon monoxide (CO) production.</td></tr>
<tr><td colspan="4">Implementation Potential</td></tr>
<tr><td>External Support</td><td colspan="2">Projected degree of external support.</td><td>1. Qualitative assessment of level of external support.</td></tr>
<tr><td>Ability to Get Outside Funding</td><td colspan="2">Qualitative assessment of opportunities for outside funding.</td><td>1. Qualitative assessment of outside funding.</td></tr>
</table>

TABLE 1-4. Shared Objectives and Performance Measures from Bay Area Water Agency Coalition (BAWAC)(1)

Objective and Sub-Objective	*Local Agency Perspective Performance Measure*	*Regional Perspective Performance Measure*	*Data Inputs*
Internal Consistency with Agency Plans and Baselines	Degree of consistency with agency plans.		1. Information on local plans and projects.

(1) These objectives and performance measures represent the shared objectives of BAWAC, but do not include all the objectives and performance measures that will be used by each agency to independently evaluate the performance of the various project portfolios.

(2) The detailed environmental objectives and performance measures (Aquatic and Terrestrial Environment, Wetlands, Special-Status Species, Energy Consumption) were initially based on input from the environmental caucus, but have been further developed to identify specific issue areas that allow for differentiation and programmatic evaluation of example portfolios and concepts.

While these objectives and performance measures are shared amongst the various water agencies that make up BAWAC, individual agencies also have their own particular objectives. The participating agencies agreed to the objectives and performances measures as providing sufficient information for evaluating their participation in the various concepts and portfolios that are developed.

Each participating agency employs different value systems and decision-making processes. As a result, the relative importance of each of the Objectives and Performance Measures is likely to be different for each agency. As the participating agencies do not have a common system for evaluating concepts, concepts cannot be compared to each other. However, concepts can be evaluated with respect to their individual ability to achieve an external benchmark. Each concept and example portfolio is evaluated with respect to its ability to achieve these common objectives and performance measures.

Section 2

Planning Assumptions and Baselines

Section 2
Planning Assumptions and Baselines

This section provides an overview of the planning horizon, and agency demands, supplies and water quality conditions used to develop agency "baseline" or no project conditions. Concept and example portfolio evaluations, described in Section 4, are compared with baseline conditions to assess the incremental benefits of each concept or portfolio.

2.1 STUDY PLANNING HORIZON

The study is using a 2020 planning horizon. This time-frame was selected, as it coincides with most participating agencies' current planning horizon. The 2020 planning horizon is also the same planning horizon being used by the CALFED Common Assumptions Workgroup, which is developing standard planning studies to be used as the basis of planning for individual projects being evaluated in CALFED studies. Water supply and water quality assumptions being used in this study are based on Common Assumptions Workgroup studies, as discussed in more detail in Section 2.2.3.

2.2 STUDY AREA

Figure 2-1 shows the study area, which includes the service areas of all of the participating agencies. Four of the participating agencies, ACWD, BAWSCA, SFPUC and SCVWD overlap. ACWD and all BAWSCA member agencies (of which ACWD is a member agency) purchase wholesale water from SFPUC and are part of the SFPUC regional service area. Eight BAWSCA member agencies[1] are located in Santa Clara County and either purchase wholesale water from SCVWD or pump water from groundwater basins managed by the SCVWD, and are part of the SCVWD service area.

2.2.1 Agency Demand Projections

Table 2-1 summarizes population and municipal and industrial (M&I) demand projections for the study area. Projections for ACWD, CCWD, EBMUD, and Zone 7 reflect projected 2020 demands in these service areas. BAWSCA, SFPUC and SCVWD overlap. Both population and demand projections for these agencies are tabulated using the same methodology as used in BAWAC studies, to avoid double-counting. BAWSCA member agency projections include all BAWSCA members (SFPUC wholesale customers) with the exception of ACWD and BAWSCA members located within Santa Clara County. SFPUC projections include only SFPUC retail customers. SCVWD projections include SCVWD retail agencies as well as shared SFPUC wholesale customers located within Santa Clara County. As a result, Study Area Total population and demand reflect the projected population and demands generated throughout the study area. As shown in this table, population and M&I water use are projected to increase by 15.9% and 15.4%, respectively, by 2020. Per capita water use will remain relatively constant.

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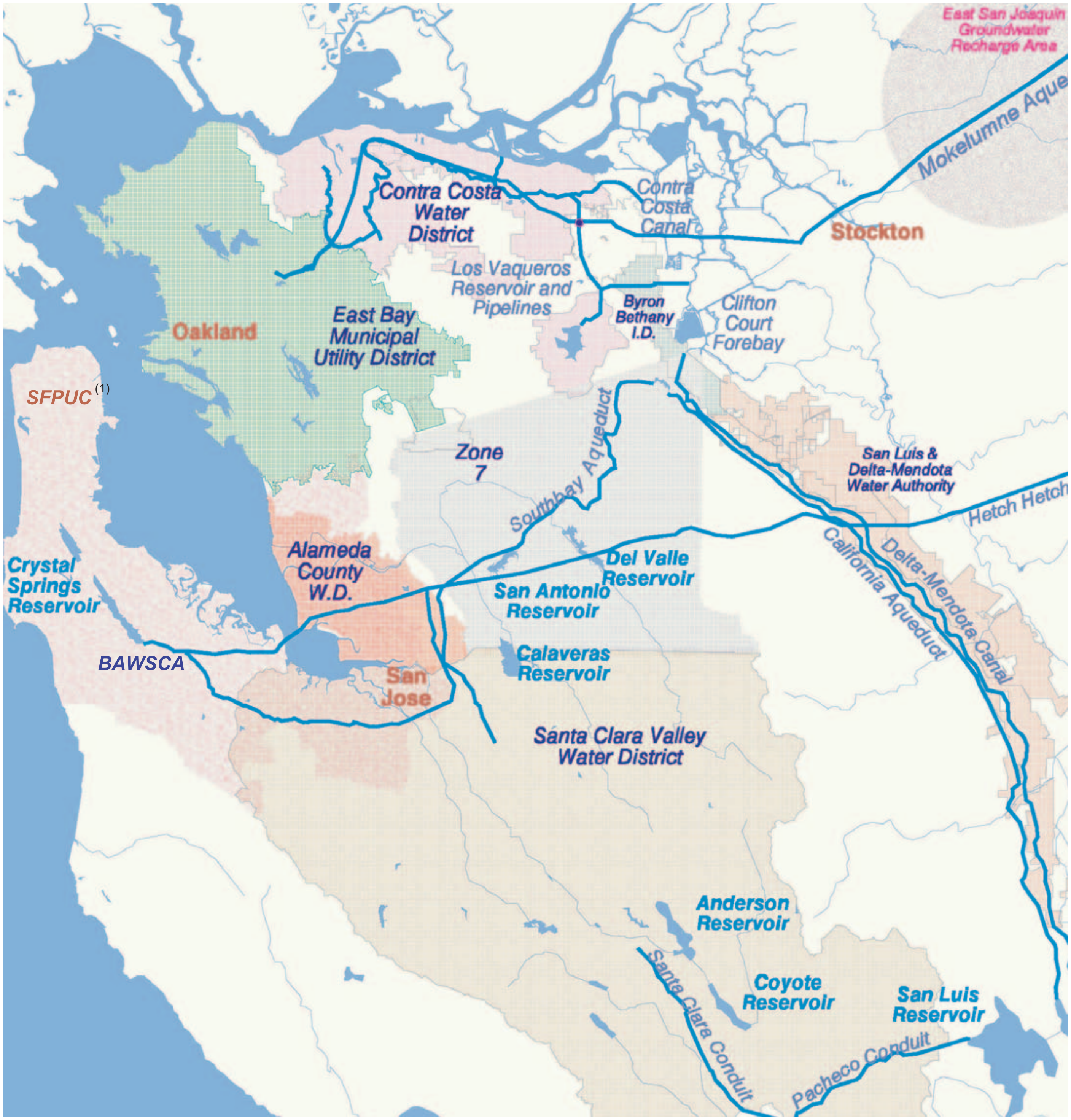
[1] Milpitas, Mountain View, No. San Jose, Santa Clara, Palo Alto, Purissima Hills, Stanford and Sunnyvale.



(1) SFPUC also serves the 28 customers represented by BAWSCA, including ACWD.

Note: Figure courtesy of EBMUD.

Figure 2-1
Participating Agencies and Service Areas

TABLE 2-1. Study Area Population and Water Demand Projections

Year	Baseline Projections							
	ACWD	*BAWSCA (w/o overlap)* (1)	*CCWD*(2)	*EBMUD*	*SFPUC (retail)* (3)	*SCVWD* (4)	*Zone 7*(5)	*Study Area Total*(6)
Population Projections								
2000	312,800	846,300	431,700	1,270,000	757,000	1,682,600	167,000	5,467,400
2005	320,600	870,300	468,400	1,340,000	772,500	1,788,300	198,300	5,758,400
2010	328,400	893,900	507,100	1,370,000	788,000	1,879,700	225,000	5,992,100
2015	336,200	916,400	530,200	1,390,000	803,500	1,949,500	246,900	6,172,700
2020	344,000	936,500	553,300	1,420,000	819,000	2,007,500	255,400	6,335,700
% Change (9)	**9.97%**	**10.66%**	**28.17%**	**11.81%**	**8.19%**	**19.31%**	**52.93%**	**15.88%**
Overall Municipal and Industrial Water Use (AFY) (7)								
2000	56,100	129,200	157,400	241,500	100,900	347,300	42,000	1,074,400
2005	55,800	137,300	175,000	245,300	99,600	369,900	50,700	1,133,600
2010	58,900	141,800	192,700	253,100	99,100	379,100	59,400	1,184,100
2015	60,600	145,000	199,900	255,400	99,000	388,300	65,800	1,214,000
2020	62,200	149,500	207,100	256,500	99,200	397,000	67,800	1,239,300
% Change (9)	**10.87%**	**15.71%**	**31.58%**	**6.21%**	**-1.68%**	**14.31%**	**61.43%**	**15.35%**
Overall Per Capita M&I Water Use (gpcd) (8)								
2000	160	136	325	170	119	184	225	175
2005	155	141	334	163	115	185	228	176
2010	160	142	339	165	112	180	236	176
2015	161	141	337	164	110	178	238	176
2020	161	143	334	161	108	177	237	175
% Change (9)	**1%**	**5%**	**3%**	**-5%**	**-9%**	**-4%**	**6%**	**0%**

Notes:

(1) BAWSCA (w/o overlap) data excludes ACWD and BAWSCA customers in Santa Clara County (Milpitas, Mountain View, No. San Jose, Santa Clara, Palo Alto, Purissima Hills, Stanford and Sunnyvale). BAWSCA 2000 data from Bay Area Water Users Association Annual Survey FY2001-2002. Other data taken from *SFPUC Wholesale Customer Water Conservation potential Technical Report, 2004.*

(2) CCWD per capita water use includes major industrial use which accounts for approximately one-third of CCWD's overall water use.

(3) SFPUC (retail) data includes SFPUC retail customers only. Note that SFPUC retail population and demand projections are based on household population and employment figures not total population and employment. SFPUC data from *City and County of San Francisco Retail Water Demands and Conservation Potential, 2004.*

(4) SCVWD data includes BAWSCA members that receive water from SFPUC and SCVWD (Milpitas, Mountain View, No. San Jose, Santa Clara, Palo Alto, Purissima Hills, Stanford and Sunnyvale).

(5) Zone 7 projections updated per April 2004 Sustainable Water Supply Report.

(6) Study Area Totals were calculated as the sum of ACWD, BAWSCA (without overlap), CCWD, EBMUD, SFPUC (retail), and SCVWD.

(7) Values represent municipal and industrial (M&I) demand only.

(8) Overall per capita water use is calculated as "Overall Water Use" divided by "Population".

(9) % Change reflects the projected increase in each quantity between 2000 and 2020.

The development of demand projections for the study area was based largely on data collected as part of the BAWAC "Advancements in Water Conservation" project and "Innovative Water Management Elements" project, with updated information from *City and County of San Francisco Retail Water Demands and Conservation Potential* (SFPUC, 2004) and *SFPUC Wholesale Customer Demand Projections* (SFPUC, 2004), as well as updated SCVWD projections.

For more detailed information on demands, see Appendix B.

2.2.2 Agency Supplies and Water Quality

Future agency baseline supply and water quality conditions were established for three hydrologic conditions: critical dry year, extended dry year, and average year hydrology. The future baselines are based on monthly flow and water quality data that are intended to represent the year 2020 projected supply and water quality conditions for an agency's major sources of supply during the three different hydrologic conditions. Because of the variety of sources of water used in the Bay Area, agencies use different hydrological conditions as their "worst case" for planning purposes, and the three sets of conditions used in this study may not include an agency's worst case.

Three source water quality constituents: TOC, TDS and bromide were selected as key water quality parameters, based on their influence on disinfection by-product generation and aesthetics. Based on quantity and quality of existing water quality data for the selected hydrologic periods, either historic or simulated data was used to develop water quality baselines.

For CALFED studies, the CalSim II water resources simulation model of the State Water Project/Central Valley Project system and Delta Simulation Model (DSM) II are being used to evaluate Delta operations, project supply yields, and associated water quality effects for existing and future operational scenarios. The CALFED Common Assumptions Workgroup has established the Common Assumptions simulation runs that are being used for various CALFED studies, so that individual studies use consistent analysis scenarios. This project is consistent with the Common Assumptions simulations runs, which are based on the Central Valley Project Operations Criteria and Plan (OCAP) Study 4, with South Bay Aqueduct operations as updated by the Los Vaqueros Expansion (LVE) Studies team,[2] for agencies receiving State or Federal water from the Sacramento-San Joaquin Delta.

DSM II was used by the Expanded Los Vaqueros Studies team to simulate chloride water quality at Clifton Court, Rock Slough, Old River at Tracy, and Middle River. Bromide and TDS concentrations were estimated from chloride data using the relationships:

- Bromide =0.00341 x chloride - 0.033,
- TDS =1.828 x chloride + 118.8 (seawater equation), and
- TDS = 4.08 x chloride + 30.2 (agricultural drainage)

The higher value of the two TDS/chloride calculations was used to estimate TDS[3].

Estimated bromide and TDS data developed from simulated chloride data were used in conjunction with simulated State Water Project (SWP) and Central Valley Project (CVP) supplies. Historic dissolved organic carbon (DOC) monitoring data collected at the Harvey O. Banks Pumping Plant (H.O.B.) was used to simulate South Bay Aqueduct (SBA) and CVP TOC.

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[2] This simulation includes 2020 level of development and hydrology, Central Valley Improvement Act 3406(b)2 provisions, South Delta Improvements, Freeport Regional Water Project, and H.O.B. at 8,500 cfs capacity. The Expanded Los Vaqueros study team used this run as a basis for Expanded Los Vaqueros operations, and included operations for the Environmental Water Account.

[3] CALFED Los Vaqueros Expansion Studies Reservoir Water Quality Technical Memorandum, July 2004.

Other water supply and water quality baselines were developed from simulated or historic data, based on review of data with each agency. Table 2-2 summarizes supply and water quality baseline information by agency. For more information on agency supply and water quality information, see Appendix C.

TABLE 2-2. Water Supply and Water Quality Baselines Used for Study

Agency	*Water Supply Sources*	*Source of Water Supply Estimates*	*Source of Water Quality Data*
ACWD	State Water Project	ACWD 2020 Projections (1)	DSM 2 Modeling Based on OCAP Study 4 as Modified by LVE Studies Team
	SFPUC Purchase	ACWD 2020 Projections	SFPUC Monitoring Data
	Local Watershed and Groundwater	Not evaluated	Not evaluated
BAWSCA Member Agencies	SFPUC Purchase	SFPUC Estimates	SFPUC Monitoring Data
	SCVWD	OCAP Study 4 as Modified by LVE Studies Team	DSM 2 Modeling Based on OCAP Study 4 as Modified by LVE Studies Team
	Local Groundwater	Not evaluated	Not evaluated
	Local Watersheds	Not evaluated	Not evaluated
CCWD	CVP	OCAP Study 4 as Modified by LVE Studies Team	DSM 2 Modeling Based on OCAP Study 4 as Modified by LVE Studies Team
	East Contra Costa Irrigation District (ECCID)	Not evaluated	Not evaluated
EBMUD	Mokelumne River	Historic Deliveries for Dry Years, Estimated Deliveries based on Projected Demands for Average Years	Pardee Reservoir Monitoring Data
	Sacramento River	Freeport Regional Water Project Studies	Green's Landing Monitoring Data, Coordinated Monitoring Program Data (Freeport), U.S. Geological Survey (USGS) Monitoring Data
	Local Watersheds	Not evaluated	Not evaluated
SCVWD	CVP	OCAP Study 4	Not evaluated
	State Water Project	OCAP Study 4 as Modified by LVE Studies Team	DSM II Modeling Based on OCAP Study 4 as Modified by LVE Studies Team
	Local Groundwater	Not evaluated	Not evaluated
SFPUC	Tuolumne River	Historic Deliveries for Dry Years, Estimated Deliveries based on Projected Demands for Average Years	SFPUC Monitoring Data
	Alameda System	Historic Deliveries	SFPUC Monitoring Data
	Peninsula System	Historic Deliveries	Not evaluated
Zone 7	State Water Project	OCAP Study 4 as Modified by LVE Studies Team	DSM 2 Modeling Based on OCAP Study 4 as Modified by LVE Studies Team
	Local Groundwater	Not evaluated	Not evaluated

(1) Because of inconsistent hydrologic simulation time frames, LVE studies were not updated to include latest ACWD baseline assumptions. This study uses current ACWD baseline, while LVE studies are using ACWD baseline conditions based on earlier studies.

Each of the project concepts and example portfolios were analyzed to determine the incremental water supply and water quality benefits, as compared with baseline conditions. This analysis is described in Section 4.

2.2.3 Agency Water Treatment

Projected water quality impacts and/or benefits associated with concepts and example portfolios being analyzed in this study are evaluated both before and after treatment. The treatment processes assumed to be in place for each agency by the year 2020 are summarized in Table 2-3.

For more information, refer to Appendix D of this document.

TABLE 2-3 - Planned Treatment Processes(1)

Treatment Plant	Supply Source	Process															
		Carbon Dioxide	Coagulation	Flocculation	Sedimentation	Filtration	Ultrafiltration	Granular Activated Carbon	Powdered Activated Carbon	Washwater Clarification	Pre-ozonation	Settled Water Ozonation	Post-ozonation	Chlorine	Chlorine Dioxide	Hydrogen Peroxide	Sulfuric Acid
ACWD																	
Mission San Jose(2)	Delta (SBA)(3)		◆	◆	◆		◆		◆					◆			
WTP No. 2		◆	◆	◆	◆	◆					◆			◆			
CCWD																	
Randall-Bold	Delta		◆	◆	◆	◆		◆				◆	◆	◆			
Bollman			◆	◆	◆	◆		◆				◆		◆			◆
EBMUD																	
Sobrante	Sierra Plus Local Runoff		◆	◆	◆			◆				◆		◆			
Upper San Leandro			◆	◆	◆			◆				◆		◆			
Orinda	Sierra		◆	◆		◆								◆			
Lafayette			◆	◆		◆								◆			
Walnut Creek			◆	◆	◆	◆								◆			
SFPUC(5)																	
Harry Tracy	Sierra Plus Some Local Runoff		◆	◆	◆	◆					◆			◆			
Sunol Valley			◆	◆	◆	◆								◆			
Hetch Hetchy Aqueduct		◆												◆			
SCVWD(6)																	
Penitencia	Delta (SBA and San Luis Reservoir)(4)		◆	◆	◆	◆				◆			◆	◆		◆	◆
Santa Teresa			◆	◆	◆	◆				◆			◆	◆		◆	◆
Rinconada			◆	◆	◆	◆				◆			◆	◆		◆	◆
ZONE 7																	
Del Valle	Delta (SBA)(4)		◆	◆	◆	◆								◆			
Patterson Pass I			◆	◆	◆	◆								◆			
Patterson pass II			◆	◆	◆		◆							◆			
Altamont(2)			◆	◆	◆	◆	◆							◆			

(1) All plants assumed to use chloramines disinfection.

(2) Facility currently being upgraded for disinfection optimization – process currently under design. Process will include either filtration or ultrafiltration.

(3) Treatment process to be determined.

(4) A portion of SBA supply to ACWD, SCVWD, and Zone 7 is conveyed through Del Valle Reservoir prior to treatment at the facilities listed above. Del Valle Reservoir operations, and potential water quality effects associated with reservoir operation, have not been considered as part of the Program.

(5) SFPUC treats all supply delivered to BAWSCA agencies

(6) SCVWD treats all supply delivered to BAWSCA agencies in Santa Clara County

Section 3

Development of Phase 2 Concepts and Portfolios

Section 3

Development of Phase 2 Concepts and Example Portfolios

Phase 1 of the Program identified several categories of concepts and proposed initial concepts for each category. In Phase 2, the concepts were refined, and categories reframed to more appropriately group the concepts. Through this process, additional concept detail was developed, and new concepts were added. Those concepts failing to meet Program requirements, deemed infeasible by agencies, or failing to mature were screened from the Program, and the remaining concepts were retained for detailed evaluation in Phase 2. Figure 3-1 illustrates the concept development process.

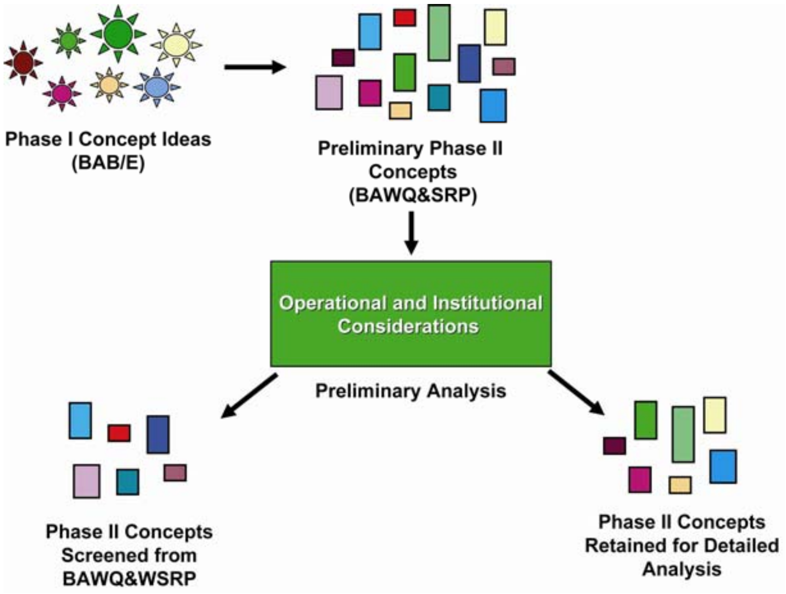

Figure 3-1
Concept Development Schematic

The following sections describe the process of developing the concepts to be carried forward in Phase 2 of the program. Additionally, a summary of retained concepts is provided, including information on operations, potential beneficiaries and costs. Lastly, discussion of the example portfolios, including the themes and concept groupings used to develop these portfolios, is presented.

3.1 CONCEPT DEVELOPMENT

This section describes the process of developing the preliminary concepts identified in Phase 1 of the Program into more detailed concepts to be carried forward for evaluation in Phase 2.

3.1.1 Phase I Categories and Concepts

In Phase 1 a variety of potential water quality and water supply reliability concepts were identified for possible inclusion and development in subsequent phases of the Program. These concept ideas were developed based on input from the participating agencies and were organized by source of water. Six categories of concepts were developed:

- **EBMUD Facilities/Mokelumne Aqueducts:** Various raw and treated water interties with EBMUD, potentially in conjunction with local or remote groundwater banking programs.

- **Hetch Hetchy Aqueducts:** Use of Hetch Hetchy Aqueduct to convey additional supply or to interconnect with additional agencies, potentially in conjunction with reservoir enlargement(s) and/or local or remote groundwater banking programs.

- **Capture of Additional High Quality Delta Water:** Use of existing or expanded Delta facilities to convey additional water when Delta water quality is high, potentially in conjunction with local or remote groundwater banking.

- **Enhanced Local Surface Supplies and Other Local Options:** Use of reservoir expansions and operating alternatives to capture additional local runoff and/or improve water quality, potentially in conjunction with local or remote groundwater banking.

- **Alternative Sources:** Improved water supply reliability and/or water quality through the use of alternative sources of supply not currently in use, including new supply alternatives, as well as blending and exchange alternatives.

- **Concepts Outside of Program that should be addressed by CALFED as Part of a Comprehensive Assessment:** Implementation of concepts that may provide benefits as assessed by the Program objectives and performance measures, but which fall outside of the scope of the Program.

Table 3-1 includes the potential concepts initially proposed for each category.

TABLE 3-1. Phase I Categories and Concepts
EBMUD Facilities/Mokelumne Aqueducts
▪ Intertie between Mokelumne Aqueduct and the Contra Costa Canal, SBA, Los Vaqueros Reservoir, and/or Del Valle Reservoir; ▪ Treated water connections from EBMUD to Zone 7 and/or ACWD for conjunctive use or direct delivery and local and/or remote groundwater banking concepts.
Hetch Hetchy Aqueducts
▪ New San Joaquin Pipeline No. 4 and larger Calaveras reservoir to store imported water; ▪ Intertie with Hetch Hetchy Aqueduct and the SBA; ▪ Intertie with Hetch Hetchy Aqueduct and the Los Vaqueros Reservoir; ▪ Use of Del Valle Reservoir in conjunction with the Hetch Hetchy Aqueduct (delivery to SCVWD and/or ACWD service areas, avoiding SWP facilities).
Capture of Additional High-Quality Delta Water
▪ SBA expansion; ▪ Del Valle Reservoir expansion; ▪ Intertie between an existing or expanded Los Vaqueros and an existing or expanded SBA; ▪ CCWD's Old River pump station expansion; ▪ Pacheco Reservoir expansion and expansion of corresponding facilities to connect to the San Felipe system and California Aqueduct/Delta Mendota Canal (DMC).
Enhanced Local Surface Supplies and Other Local Options
▪ Capture of additional local runoff (i.e., through additional reservoir storage) to blend directly with Delta supplies; ▪ Exchange agreements involving water stored in Los Vaqueros Reservoir and Byron Bethany Irrigation District diversions and other parties; ▪ Re-operation of existing or expanded Del Valle Reservoir for water quality enhancement; ▪ Development of multi-party exchanges to facilitate one or more of the above options.
Alternative Sources
▪ Desalination of Bay (and/or brackish groundwater) to directly blend with Delta supplies; ▪ Non-potable water recycling projects (for irrigation and/or industrial use); ▪ Transfer or substitution of water for non-potable demands.
Concepts Outside of BAB/E Studies that should be addressed by CALFED as Part of a Comprehensive Assessment
▪ Delta treatment facility near South Bay Pumping Plant; ▪ Source control (e.g., watershed management program along South Bay Aqueduct).

3.1.2 Phase 2 Categories and Concepts

During Phase 2 of the Program, the technical team evaluated the preliminary concepts proposed in Phase 1, based on their ability to provide water supply and/or water quality benefits and agency interest. Some preliminary concepts were eliminated, and additional concepts were added. The Phase 1 categories were reframed to more appropriately describe the concepts being considered for evaluation in Phase 2. Rather than having concepts sorted by water source, they were sorted by water management approach. Seven new categories were developed:

- **Groundwater Storage/Conjunctive Use:** Optimization of surface and groundwater supplies, commonly using groundwater banking, in which the aquifer is recharged with surplus surface waters in wet years, and is stored for use in dry years. In Phase 1, local and/or remote groundwater banking concepts were included in every concept category identified. As such, concepts identified in this category could be mapped back to any of the original Phase 1 categories, largely based on concept location.

- **Surface Water Storage:** Maximizing surface water storage capabilities and associated conveyance facilities to meet demands with high quality water. These project concepts may provide value for water quality, dry year supply, and emergency supply. Several of these concepts involve expanding existing reservoirs in order to allow water to be transferred at times of highest quality. Other project concepts involve devising new conveyance strategies to optimize water resource distribution, allowing supplies to be distributed in the most efficient way possible, and allowing blending for water quality improvement. This concept category is an analog to the Phase 1 concept category Enhanced Local Surface Supplies and Other Local Options.

- **Enhanced Conservation:** Each of the Bay Area partners has developed ongoing conservation programs as part of their demand management strategy. These current and planned programs include, but are not limited to: residential water-use surveys, plumbing retrofits, landscape audits and incentives, washing machine rebates, education and outreach, commercial, industrial and institutional audits and incentives, and ultra-low flow toilet rebates. It is estimated that current and planned conservation measures will yield approximately 180,000 AFY in water use savings by the year 2020. The Enhanced Conservation Concept includes activities that could potentially augment current conservation programs undertaken and planned to be undertaken by the Bay Area partners. The Enhanced Conservation Concept includes projects above and beyond the projected 180,000 AFY of conservation projects currently being planned by the year 2020.

- **Water Recycling:** Reuse of treated wastewater to offset potable water demands. A variety of uses have been identified, including irrigation and industrial cooling. Twenty-six recycling projects were initially identified for inclusion in this study, with potential dry-year yields ranging from 200 AFY to 18,000 AFY.

- **Desalination:** Removal of salts and minerals from water, generally accomplished by reverse osmosis. This concept category makes use of alternative sources of supply, and is an analog to the Phase 1 category of Alternative Sources.

- **Conveyance:** Use of new or expanded conveyance facilities to improve water quality and/or water supply reliability. In some cases, conveyance concepts initially proposed in Phase 1 were included with storage concepts to make complete concepts.

- **Other:** Concepts considered which do not fall within one of the six categories described above.

Initial Phase 2 Concepts were evaluated and subjected to preliminary screening based on three criteria established by the technical team and participating agencies:

- Concepts must benefit more than one participating agency;
- Concepts cannot already be planned for implementation independently from this study (e.g., already included in a master plan or capital improvement program);
- Concept must be sufficiently mature to evaluate in this study.

In addition to the main screening criteria, potential concepts were excluded if the owning agency did not agree to include the concept. Further, some potential concepts were excluded based on previous studies deeming them infeasible.

Important considerations associated with the various concept categories are discussed below.

3.1.2.1 Groundwater Storage/Conjunctive Use

Important considerations for concepts in this category include impacts to basins that might emanate from exploitation and overdraft by entities who are not the designated stewards of the ground water resources. In addition, many of these project concepts rely on the assumption that surplus surface water will be available in wet years to recharge the depleted aquifers, without considering the necessary facilities to effect that recharge. No concepts in this category were retained for analysis in Phase 2 of the Program. Retained and excluded concepts can be seen in Table 3-2.

3.1.2.2 Surface Water Storage

Important considerations for concepts in this category include the trade-offs between maximizing water quality, minimizing environmental impacts, and maximizing yield. If deliveries are timed to improve water quality and reduce environmental impacts, the increased reservoir volumes may not accomplish the goal of providing yield. Conversely, maintaining storage for dry year yield will reduce flexibility of operation for maximizing water quality. Further, it is important to ensure that sufficient hydraulic conveyance capacity is available for fill and draw operations so that stored water can be most effectively used. Two concepts in this category were retained for analysis in Phase 2 of the Program. Retained and excluded concepts can be seen in Table 3-2.

3.1.2.3 Enhanced Conservation

Important considerations identified with Enhanced Conservation are related to the reliance on the end-user to implement conservation measures, as well as the difficulty in quantifying potential water savings resulting from these measures. Enhanced Conservation is unique in that its success depends wholly upon customer participation in programs, which cannot be controlled, and may be difficult to predict, by the implementing agency. Because of these concerns, enhanced conservation was not evaluated as a source of water for exchange, but as a water supply reliability concept for the agency whose customers are conserving.

TABLE 3-2. Phase I and Phase II Category and Concept Screening

Concept	Description	Status
Groundwater Storage/Conjunctive Use		
Westside Basin In-Lieu Recharge	Conjunctive use of the Westside Basin located in San Mateo County/South San Francisco County.	Screened Out. Concept is being carried forward by the SFPUC and several BAWSCA agencies independently from this Program.
Groundwater Storage/In-Lieu Recharge in Palo Alto	Storage of surplus high quality water in wet years for use in dry years. Basin would recharge in wet years. The basin would be fully developed with new wells and connections to the distribution system.	Screened Out. SCVWD objected based on potential impacts to the SCVWD groundwater basin.
Groundwater in Mountain View	Storage of surplus high quality water in wet years for use in dry years. Basin would recharge in wet years. The basin would be fully developed with new wells and connections to the distribution system.	Screened Out. SCVWD objected based on potential impacts to the SCVWD groundwater basin.
Bayside Groundwater Storage	Local supplies injected into the deep aquifer during wet years and extracted in dry years.	Screened Out. Going forward independently from the Program.
Bixler Groundwater Storage	Excess Mokelumne River or other supplies injected into the deep aquifer during wet years and extracted in dry years.	Screened Out. EBMUD the only beneficiary identified.
Sunol Basin	No description available	Screened Out. Failed to mature; not enough information available.
Surface Water Storage		
Calaveras Reservoir Expansion	Expansion up to 420,000 AF. Water supply and water quality operations included.	Retained.
Los Vaqueros Reservoir Expansion I	Reservoir expansion to 300,000 AF and 1,000 cubic feet per second (cfs) intake.	Not included. Only one operating scenario, the 500,000 AF, 1,750 cfs intake Multipurpose Operation, was retained as an example operation of the Los Vaqueros Reservoir Expansion.
Los Vaqueros Reservoir Expansion II	Reservoir expansion to 500,000 AF and 1,000 cfs intake.	Not included. Only one operating scenario, the 500,000 AF, 1,750 cfs intake Multipurpose Operation, was retained as an example operation of the Los Vaqueros Reservoir Expansion.
Los Vaqueros Reservoir Expansion III	Reservoir expansion to 500,000 AF and 1,750 cfs intake.	Retained. Multipurpose Operation evaluated as an example operation of the Los Vaqueros Reservoir Expansion.
San Luis Low Point Project	Construction of a reservoir bypass canal, expansion of the San Felipe area reservoirs, water treatment alternatives, algae harvesting or algaecide application, lowering the intake facilities, and/or combined district solutions.	Screened Out. Benefits to primarily one Bay Area agency and other CVP & SWP contractors.
Re-operation and/or Expansion of Del Valle Reservoir	Expansion and/or re-operation of Del Valle Reservoir for water quality and supply reliability benefits.	Screened Out. Potential re-operation of Del Valle Reservoir was evaluated and the additional yield was not found to be cost-effective.
Pacheco Reservoir Expansion	Expansion of Pacheco Reservoir and expansion of corresponding facilities to connect to the San Felipe system and California Aqueduct/DMC.	Screened Out. This is part of the San Luis Low Point Project, which was screened out.
Capture of Additional Local Runoff	Capture of additional local runoff (i.e., through additional reservoir storage) to blend with Delta supplies.	Retained. Not a stand-alone project; retained as part of the Los Vaqueros and Calaveras Reservoir Expansion concepts.

TABLE 3-2. Phase I and Phase II Category and Concept Screening

Concept	*Description*	*Status*
Enhanced Conservation		
Enhanced Conservation(1)(4)	Non cost-effective and regional measures beyond the current and planned 180,000 AF.	Retained.
Tiered Pricing(4)	Use of a tiered pricing structure to promote conservation.	Screened Out. Water that could be developed is generally the same water that could be estimated to be conserved using water saving appliances or landscaping changes. Consistent with the WUE 4 year evaluation, tiered pricing was considered a tool that local agencies could use to implement water conservation measures.
Water Recycling		
Non-Potable Recycled Water Concepts(2) (4)	Twenty-six recycling projects with potential dry-year yields ranging from 200 AFY to 18,000 AFY.	Retained.
Desalination		
C&H Sugar, Crockett	Desalination at C&H Sugar in Crockett, evaluated by the RDP.	Screened Out. Excluded due to elimination by the RDP based on high cost and small size. May be pursued by fisheries industry.
Desalination of Bay Water (and/or brackish, groundwater)	Desalination of bay and/or brackish groundwater to directly blend with Delta supplies	Retained. The South Bay Desalination, East Bay Saline Groundwater Desalination, Mirant Desalination with Water Quality Element, Near Bay Bridge with Water Quality Element, and Regional Desalination Project concepts are bay, brackish, or groundwater desalination concepts.
Mirant Contra Costa Plant, Antioch	Desalination at Mirant Contra Costa Plant in Antioch, evaluated by the RDP.	Screened Out. Excluded due to elimination by the RDP (Pittsburg site retained instead but two sites are generally similar).
Mirant Pittsburg, Pittsburg	Desalination at Mirant Pittsburg in Pittsburg, evaluated by the RDP.	Retained. While not included individually, this concept is included as part of the RDP concept.
Palo Alto Water Regional Pollution Control Plant (RPCP), Palo Alto	Desalination at Palo Alto RPCP in Palo Alto, evaluated by the RDP.	Retained. This concept was eliminated from RDP based on size. Due to different screening criteria, it was retained for this project.
Pico Power Plant, Santa Clara	Desalination at Pico Power Plant in Santa Clara, evaluated by the RDP.	Retained. This concept was eliminated from RDP based on size. Due to different screening criteria, it was retained for this project.
Los Esteros Power Plant, San Jose	Desalination at Los Esteros Power Plant in San Jose, evaluated by the RDP.	Retained. This concept was eliminated from RDP based on size. Due to different screening criteria, it was retained for this project.
Treasure Island	Desalination at Treasure Island, evaluated by the RDP.	Screened Out. Excluded due to elimination by the RDP based on high cost, environmental concerns with pipeline across the bay.
Oceanside, San Francisco	Desalination at Oceanside in San Francisco, evaluated by the RDP.	Retained. While not included individually, this concept is included as part of the RDP concept.

TABLE 3-2. Phase I and Phase II Category and Concept Screening

Concept	Description	Status
BDPL 1&2 at Dumbarton Point, San Francisco	Desalination at the Bay Division Pipelines (BDPL) 1&2 at Dumbarton Point, evaluated by the RDP.	Screened Out. Excluded due to elimination by the RDP based on poor public perception, concerns with new South Bay discharges, high cost, and permitting considerations.
Near Bay Bridge	Desalination near the EBMUD Regional Wastewater Treatment Plant (WWTP), located in Oakland at the eastern end of the Bay Bridge, evaluated by the RDP.	Retained. While not included individually, this concept is included as part of the RDP concept.
Mallard Slough	Desalination at Mallard Slough, evaluated by the RDP.	Screened Out. Excluded due to elimination by the RDP based on extensive distribution requirements, limited flow, and negative public perception.
San Francisco Airport	Desalination at the San Francisco International Airport (SFO), evaluated by the RDP.	Screened Out. Excluded due to elimination by the RDP based on high cost, permitting requirements, and negative public perception.
Barge Mounted Plant	Barge-mounted desalination, evaluated by the RDP.	Screened Out. Excluded due to elimination by the RDP based on difficulties with water rights and permitting.
Regional Desalination Project	EBMUD, CCWD, SFPUC, and SCVWD project evaluated 13 desalination sites for meeting reliability needs. Four sites selected for further evaluation in future phases of that project.	Retained.
Mirant Pittsburg or Antioch Desalination with Water Quality Element(3)	Desalination at the Mirant Pittsburg or Antioch site as described in RDP, including EBMUD interconnection plus average year water quality benefit to Zone 7.	Retained.
Near Bay Bridge Desalination with Water Quality Element(3)	Desalination at the Near Bay Bridge site as described in RDP, including EBMUD interconnection plus average year water quality benefit to Zone 7.	Retained.
East Bay Saline Groundwater Desalination	Saline Groundwater Desalination in Newark or Fremont connecting to ACWD's distribution system and/or BDPLs.	Retained.
Conveyance		
Bay Area Use of the Freeport Regional Water Project(3)	Interconnection between EBMUD and Zone 7 allowing conveyance of water through the Freeport facilities to Zone 7 for average year water quality benefits.	Retained.
Mokelumne Aqueduct Projects	Potential interties between the Mokelumne Aqueduct and Contra Costa Canal, South Bay Aqueduct, Los Vaqueros Reservoir, and/or Del Valle Reservoir.	Screened Out. EBMUD-CCWD interconnection part of Freeport settlement. Major infrastructure requirements and potential water rights issues associated with interconnection between Mokelumne Aqueduct and SBA, Los Vaqueros Reservoir, and/or Del Valle Reservoir(1).

TABLE 3-2. Phase I and Phase II Category and Concept Screening

Concept	Description	Status
Hetch Hetchy Aqueduct Projects	New San Joaquin Pipeline No. 4 and larger Calaveras to store imported water; intertie with Hetch Hetchy Aqueduct and SBA; intertie with Hetch Hetchy Aqueduct and Los Vaqueros Reservoir; and/or use of Del Valle Reservoir in conjunction with the Hetch Hetchy Aqueduct (delivery to SCVWD and/or ACWD avoiding SWP facilities).	Retained. New San Joaquin Pipeline No. 4 and larger Calaveras to store imported water, and interconnection with the SBA retained as part of Calaveras Reservoir Expansion concept. Intertie from Hetch Hetchy Aqueduct to Los Vaqueros and/or Del Valle Reservoirs not practical due to infrastructure requirements. Intertie from Los Vaqueros Reservoir to SFPUC to be evaluated in future studies.
South Bay Aqueduct Expansion	Expansion of South Bay Aqueduct.	Screened Out. Expansion of the reaches serving Zone 7 is currently underway. Expansion beyond those reaches was found to not be cost-effective.
Other		
EBMUD - Zone 7 and/or EBMUD - ACWD intertie	Treated water connections from EBMUD to Zone 7 and/or ACWD.	Retained. Not a stand-alone project; the treated water interconnection between EBMUD and Zone 7 incorporated as part of Bay Area Use of the Freeport Regional Water Project and Mirant Desalination with Water Quality Element concepts.
Los Vaqueros Reservoir – SBA Intertie	Intertie between an existing or expanded Los Vaqueros Reservoir and the South Bay Aqueduct.	Retained. Not a stand-alone project; retained as part of the Los Vaqueros Reservoir Expansion.
Old River Pumping Plant Expansion	Expansion of CCWD's Old River Pumping Plant.	Retained. Not a stand-alone project; retained as part of the Los Vaqueros Reservoir Expansion Project.
Los Vaqueros Reservoir – Byron Bethany Irrigation District agreements	Exchange agreements involving water stored in Los Vaqueros Reservoir and Byron Bethany Irrigation District diversions and other parties.	Retained. Not a stand-alone project; retained as potentially part of the Expanded Los Vaqueros concept.
Development of Multi-Party Exchanges	Development of multi-party exchanges to facilitate concepts.	Retained. Where applicable, multi-party exchanges are included in each retained concept.
Tuolumne and Mokelumne water exchanges(4)	Water exchanges with water users on the Tuolumne and Mokelumne systems.	Screened Out. Limited potential benefit and many institutional hurdles(5). Deferred to agencies as part of WUE Program implementation.
Non-Potable Water Exchanges	Transfer or substitution of water for nonpotable demands.	Retained. Included as part of the water recycling and South Bay Desalination for Irrigation and/or Industrial uses.

(1) Includes activities not currently projected to be cost-effective within the study timeframe. Many of the participating agencies are already implementing water efficiency incentives, including technologies (e.g., commercial dishwashers, low flow pre-rinse spray nozzles, x-ray processor technology); education and incentives for new water efficient landscape technologies (e.g., self-adjusting evapotranspiration (ET) based sprinkler timers, drought tolerant gardening); and pricing incentives (e.g., tiered rate structures). Includes opportunities for regional cooperation to increase effectiveness of certain measures (e.g., regional public outreach, regional research collaboration, regional efforts to standardize product labeling, development of a Bay Area School sponsored Conservation Calendar, and regional collaboration on Demonstration Gardens and Bay Area Landscaping Guides). For more information, refer to Appendix E.

(2) For a description of the 26 projects, see Section 3.2.3.

(3) EBMUD Mokelumne River water rights require that any agency that is to receive a new supply via the EBMUD system is physically able to receive that supply directly if conveyed through the EBMUD system. If there is no connection between the new supply and the potential benefiting agency that would allow use of that supply directly, rather than an exchange for Mokelumne water, then there is likely to be a Mokelumne River water rights issue associated with that supply. As a result, only the Zone 7 may receive water conveyed through the EBMUD system, via the interties described in the Mirant Desalination with Water Quality Element, Bay Area Use of the Freeport Regional Water Project, and Near Bay Bridge Desalination with Water Quality Element concepts.

(4) Concept identified by Marguerite Young of Clean Water Action and Spreck Rosekrans of Environmental Defense in a letter dated November 14, 2001.

(5) Initial examination showed little water that could be transferred. In the Mokelumne and Tuolumne drainages, a large percentage of applied water returns to the rivers and could not be transferred without impacting downstream diverters. Only the smaller percentage of applied water cost to evaporation/transpiration is available for transfer. While conservation in these areas could potentially be justified based on local environmental and other quantifiable objectives, the potential benefit associated with out-of-basin transfers was considered too small. Further, numerous institutional obstacles (e.g., local opposition, legal constraints) exist. Additional conservation in these areas was left to local agencies to implement as part of the WUE program element.

To provide a water quality benefit, the Enhanced Conservation concept would need to free up high quality EBMUD or SFPUC supply for water quality exchanges with Delta users. However, the SFPUC considers demand reductions achieved through conservation measures and water recycling necessary to meet projected future baseline demand, preventing the possibility of exchange with other agencies unless those agencies provided a replacement supply. The combined cost of recycling and the replacement supply was considered prohibitively expensive. EBMUD indicated that Mokelumne River water rights issues would generally preclude exchange of conserved Mokelumne supplies with other agencies[1]. As such, Enhanced Conservation is not considered to benefit multiple agencies.

While the Enhanced Conservation concept provides tangible benefits to only the participating agency, the potential for reduced environmental impact or environmental benefit from implementation of these concepts may provide a benefit to the Bay Area as a whole. As a result, the Enhanced Conservation concept was carried forward for Phase 2 evaluation.

3.1.2.4 Water Recycling

The most common concerns with recycled water projects are potential groundwater quality impacts resulting from surface application of lower quality water, potential contamination of natural surface waters if mixed with recycled water for storage, environmental concerns, and emerging contaminants.

While many of the Water Recycling concepts provide tangible benefits to only one participating agency, the potential for reduced environmental impact or environmental benefit from implementation of these concepts may provide a benefit to the Bay Area as a whole. As a result, the twenty-six Water Recycling concepts were carried forward for Phase 2 evaluation.

3.1.2.5 Desalination

Desalination implementation may be limited by environmental concerns (e.g., effects to aquatic resources from impingement/entrainment or discharge of brine solution, energy consumption) and cost. In addition, desalinated water could increase the bromide levels in the municipal supply if blended with raw water of lower bromide concentration. If this water is treated by ozonation or chlorination, it could result in an increase in brominated DBPs such as bromate or bromodichloromethane (BDCM), which are of particular health concern. Five concepts in this category were retained for analysis in Phase 2 of the Program. Retained and excluded concepts can be seen in Table 3-2.

3.1.2.6 Conveyance

Depending upon the extent and location of expansion of facilities, conveyance concepts could present environmental concerns. Concepts from this category were retained as integral parts of other concepts. Retained and excluded concepts can be seen in Table 3-2.

All concepts considered in Phase 1 and their status in Phase 2 of the Program are summarized in Table 3-2, organized by Phase 2 concept category.

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[1] EBMUD Mokelumne River water rights require that any agency that is to receive a new supply via the EBMUD system is physically able to receive that supply directly if conveyed through the EBMUD system. If there is no connection between the new supply and the potential benefiting agency that would allow use of that supply directly, rather than an exchange for Mokelumne water, then there is likely to be a Mokelumne River water rights issue associated with that supply. As a result, only the Zone 7 may receive water conveyed through the EBMUD system, via the interties described in the Mirant Desalination with Water Quality Element, Bay Area Use of the Freeport Regional Water Project, and Near Bay Bridge Desalination with Water Quality Element concepts.

3.2 PHASE 2 CONCEPTS CARRIED FORWARD FOR EVALUATION

As described above, concepts considered in Phase 2 of the Program were screened for a variety of reasons. This section contains summary information on projected operations and beneficiaries for concepts retained for detailed evaluation in Phase 2. Additional detailed information, including conceptual facilities and cost estimates for each retained concept is included in Appendix E.

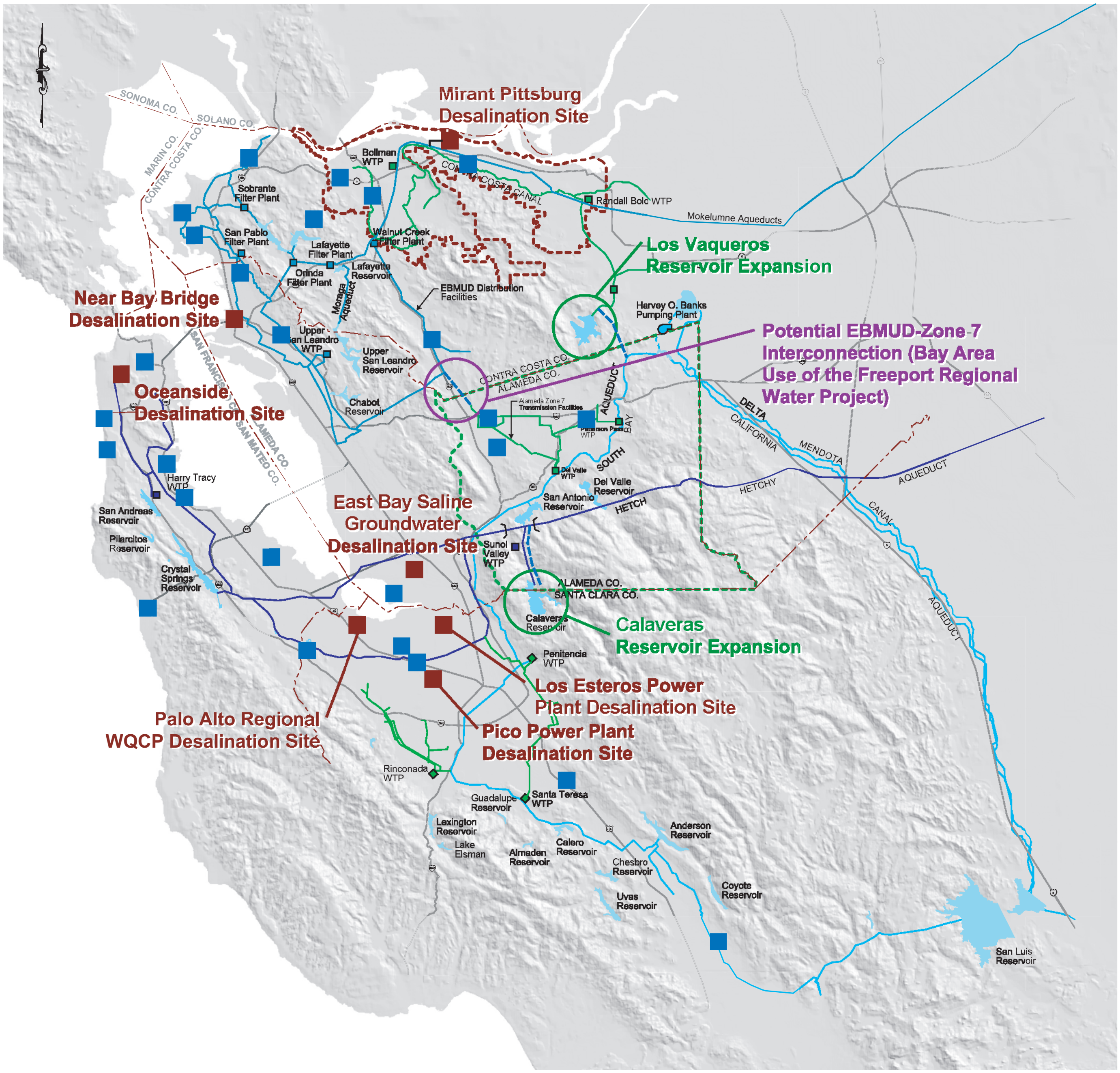
The concepts retained for evaluation, by category, are included in Table 3-3. Potential concept locations are shown in Figure 3-2.

TABLE 3-3. Phase 2 Retained Concepts

Concept	*Description*
Surface Water Storage	
Calaveras Reservoir Expansion	Expansion to 420,000 AF. Water supply and water quality operations included.
Los Vaqueros Reservoir Expansion (500,000 AF and 1,750 cfs intake)	Reservoir expansion to 500,000 AF and 1,750 cfs intake. Multipurpose Operation evaluated as an example operation of the Los Vaqueros Reservoir Expansion.
Enhanced Conservation	
Enhanced Conservation	Includes activities not currently projected to be cost-effective within the study timeframe, including incentives for water efficient technologies(1). Includes opportunities for regional cooperation to increase effectiveness of certain measures (e.g., regional public outreach, regional research collaboration, regional efforts to standardize product labeling, development of a Bay Area School sponsored Conservation Calendar, and regional collaboration on Demonstration Gardens and Bay Area Landscaping Guides).
Water Recycling	
Recycled Water Concepts(2)	Twenty-six recycling projects with potential dry-year yields ranging from 200 AFY to 18,000 AFY.
Desalination	
South Bay Desalination Concepts	
• Palo Alto Water Regional Pollution Control Plant (RPCP), Palo Alto	Brackish groundwater desalination at Palo Alto RPCP in Palo Alto.
• Pico Power Plant, Santa Clara	Brackish groundwater desalination at Pico Power Plant in Santa Clara.
• Los Esteros Power Plant, San Jose	Brackish groundwater desalination at Los Esteros Power Plant in San Jose. Retained.
Regional Desalination Project	EBMUD, CCWD, SFPUC, and SCVWD project evaluated 13 desalination sites for meeting reliability needs. Three sites selected for further evaluation in future phases of that project: Oceanside, Near Bay Bridge, Mirant Pittsburg.
Mirant Pittsburg or Antioch Desalination with Water Quality Element	Desalination at the Mirant Pittsburg or Antioch site as described in RDP, including EBMUD interconnection with and average year water quality benefit to Zone 7.
Near Bay Bridge Desalination with Water Quality Element	Desalination at the Near Bay Bridge site as described in RDP, including EBMUD interconnection with and average year water quality benefit to Zone 7.
East Bay Saline Groundwater Desalination	Saline Groundwater Desalination in Newark or Fremont connecting to ACWD's distribution system and/or SFPUC's BDPLs.
Conveyance	
Bay Area Use of the Freeport Regional Water Project	Interconnection between EBMUD and Zone 7 allowing conveyance of water through the Freeport facilities to Zone 7 for average year water quality benefits.

(1) Many of the participating agencies are already implementing water efficiency incentives, including technologies (e.g., commercial dishwashers, low flow pre-rinse spray nozzles, x-ray processor technology); education and incentives for new water efficient landscape technologies (e.g., self-adjusting evapotranspiration (ET) based sprinkler timers, drought tolerant gardening); and pricing incentives (e.g., tiered rate structures).

(2) For a description of the 26 projects, see Section 3.2.3.



Legend

- 🟥 Desalination Concepts
- ○ Conveyance Concepts
- ○ Surface Water Storage Concepts
- 🟦 Water Reycling Concepts

Figure 3-2
Locations of Retained Concepts

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3.2.1 Surface Water Storage

Two surface water storage concepts were carried forward for detailed evaluation: the Calaveras Reservoir Expansion and Los Vaqueros Reservoir Expansion concepts.

3.2.1.1 Calaveras Reservoir Expansion

The Calaveras Reservoir Expansion could potentially involve an increase in capacity from the existing size of 97,000 AF to 420,000 AF. The California Division of Safety of Dams has identified potential seismic concerns with the existing dam. A San Francisco Public Utilities Commission (SFPUC) study is currently looking at alternatives for replacement of the dam, including: replacement at the existing capacity of 97,000 AF, and initial construction at 97,000 AF with the ability to expand in the future up to 420,000 AF. The reservoir replacement at its current capacity will be used by the SFPUC to meet existing operational and supply needs.

The regional concepts considered in this study would entail a regional partnership to expand of the reservoir up to 420,000 AF, with operation to provide water quality and/or supply reliability benefits to regional participants. The regional concepts described in this write-up do not represent future operating scenarios endorsed by the SFPUC nor do they represent a complete characterization of all facilities that may be required. In addition, this concept involves the reservoir expansion only, and no specific analysis was performed to ascertain availability of additional SFPUC water for the regional concepts described.

With expansion to 420,000 AF, there are two primary operating options that are being evaluated in this study. With the first option, the additional storage of 323,000 AF (420,000 AF less 97,000 AF) is kept full the majority of the time, operating only the 97,000 AF to provide SFPUC's existing local supply needs. The additional capacity could then provide additional dry year supply reliability for potential partners, and would require use of Hetch Hetchy system or another source of supply to initially fill the expanded storage, and re-fill it following a drought. This additional stored water could be conveyed to meet SFPUC (including San Francisco retail and wholesale customers, BAWSCA member agencies) demands through the existing SFPUC transmission facilities. Flows could also be conveyed to the SCVWD/SFPUC common customers, through additional SFPUC deliveries or through use of the existing emergency connection between SFPUC and SCVWD. Another alternative for delivery to SCVWD and ACWD would be to transfer these flows into the South Bay Aqueduct in the Sunol Valley. This alternative would also provide dry year water quality improvements for ACWD and SCVWD.

The second option would be to transfer Hetch Hetchy water, or another source of supply, into the expanded Calaveras Reservoir in average and wet years, and deliver this water to the South Bay Aqueduct for an average year water quality benefit for the downstream SBA contractors ACWD and SCVWD. By providing this water quality benefit, the Calaveras Reservoir would be drawn down at the beginning of a dry period, thus reducing the potential dry year supply yield. Potential beneficiaries, supply quantities, and conceptual facilities for the Calaveras Reservoir Expansion concept are summarized in Table 3-4 and Figure 3-3.

TABLE 3-4. Calaveras Reservoir Expansion Potential Partner and Supply Amounts

Type of Benefit	*Potential Amount (AFY)*	*Notes/Issues*
ACWD		
Dry-year supply	Up to 53,000 AFY(1)	Possibility to provide dry year supply storage for the SCVWD/SFPUC common customers and possibly others. This option could also provide dry year water quality benefits to both ACWD and SCVWD if the supply was distributed into the South Bay Aqueduct.
SFPUC(2), BAWSCA		
Dry-year supply	Up to 53,000 AFY(1)	Dry year supply would apply to SFPUC retail (City and County of San Francisco) and the suburban customers (BAWSCA).
SCVWD		
Dry-year supply	Up to 53,000 AFY(1)	Possibility to provide dry year supply storage for the SCVWD/SFPUC common customers and possibly others. This option could also provide dry year water quality benefits to both ACWD and SCVWD if the supply was distributed into the SBA.
ACWD, SCVWD, BAWSCA (common customers with SCVWD)		
Average year water quality	Up to 50,000 AFY	Assumes up to 50,000 AF is transferred into Calaveras Reservoir each year to be distributed into the SBA under average year hydrologic conditions for water quality improvement. This would also reduce the dry year supply yield from up to 53,000 AFY to approximately 41,000 AFY. The total supply to all participants would be limited to 50,000 AFY for water quality benefit, and 41,000 AFY for dry year supply.

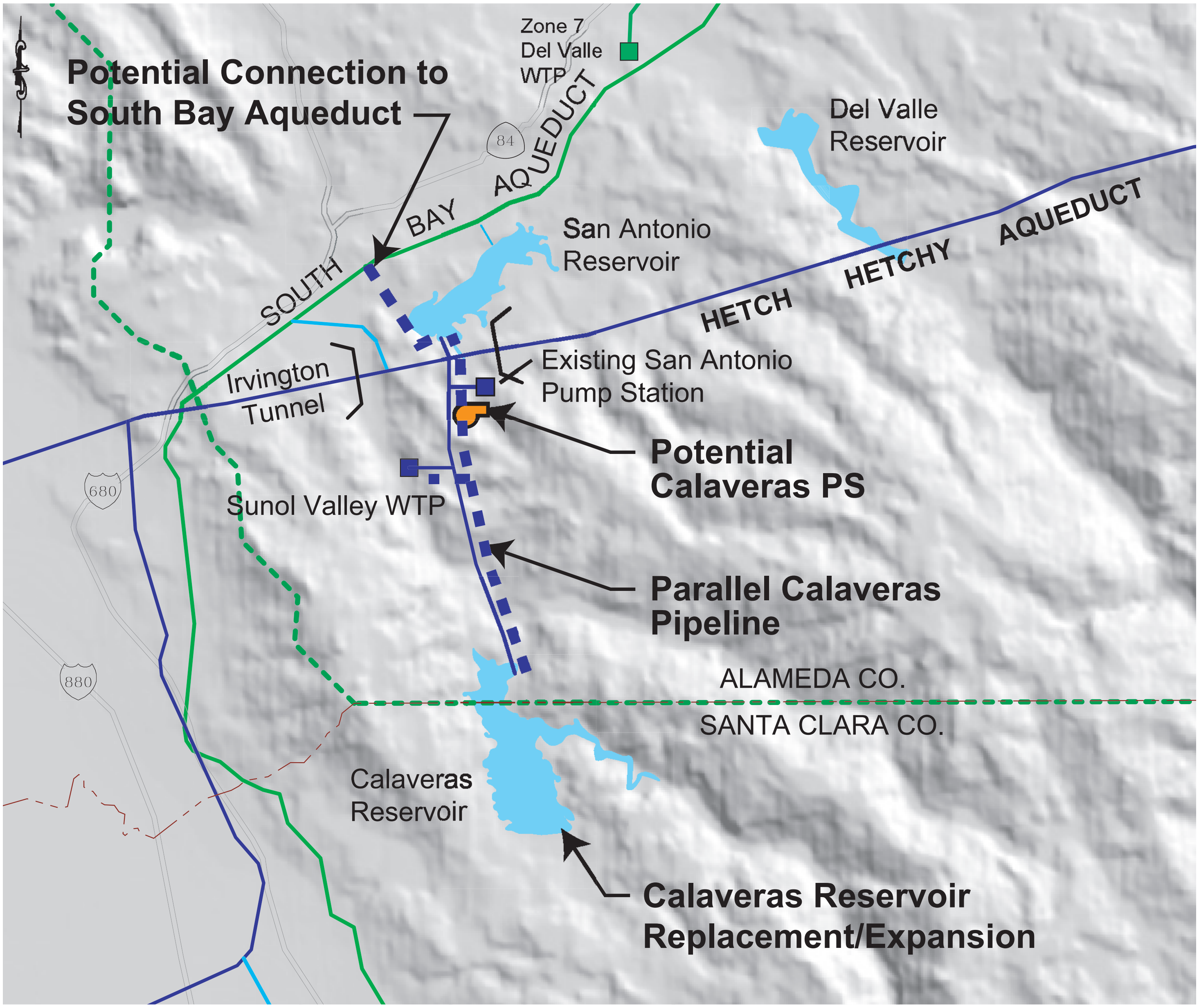
(1) The total supply available for all participants is assumed to be a maximum of 53,000 AFY.
(2) For the purposes of this study, SFPUC includes retail customers and the 28 wholesale customers, BAWSCA member agencies.

3.2.1.2 Los Vaqueros Reservoir Expansion

The Los Vaqueros Reservoir Expansion would involve an increase in capacity from the existing size of 100,000 AF up to 500,000 AF. Two reservoir capacities (300,000 AF and 500,000 AF) and two diversion capacities have been evaluated: 1,000 cfs and 1,750 cfs (500,000 AF reservoir only).

The CALFED Los Vaqueros Reservoir Expansion Studies evaluated several operating modes for the reservoir, evaluating single purpose projects (e.g., drought supply to Bay Area agencies, or operations solely in support of environmental water) to determine the extent of benefits possible, and multi-purpose scenarios to balance objectives (a combination of the drought supply and environmental water). Water quality benefits are provided in all cases.

For this Program, results from the multipurpose operating scenario with a 500,000 AF reservoir and 1,750 cfs diversion rate (Expanded Los Vaqueros Scenario 5A) are presented; this scenario has dry-year benefits, water quality benefits, and water for Environmental Water Account (EWA) management. The potential Bay Area partners for this project are CCWD, and the three SBA contractors: Zone 7, ACWD, and SCVWD. There may be potential for the SFPUC to also benefit from Los Vaqueros Reservoir Expansion. This may be considered in future studies.



CDM

Figure 3-3
Calaveras Reservoir Expansion Concept Facilities

Under the environmental water operations, the expanded Los Vaqueros Reservoir would store high quality water during periods of high Delta flow when diversions would have low impacts on aquatic resources. The project would deliver up to 165,000 AFY of Delta water to the South Bay Aqueduct via a new pipeline from the expanded reservoir to the SBA's Dyer Backsurge Pool. This operation would make up for reduced pumping at the H.O.B. and help meet EWA Program objectives to protect aquatic resources and improve habitat conditions. Water would be stored in the reservoir when Delta water quality is high, so that delivered water quality to the SBA would be improved.

Potential beneficiaries, supply quantities, and conceptual facilities for the Los Vaqueros Reservoir Expansion concept are summarized in Table 3-5 and Figure 3-4.

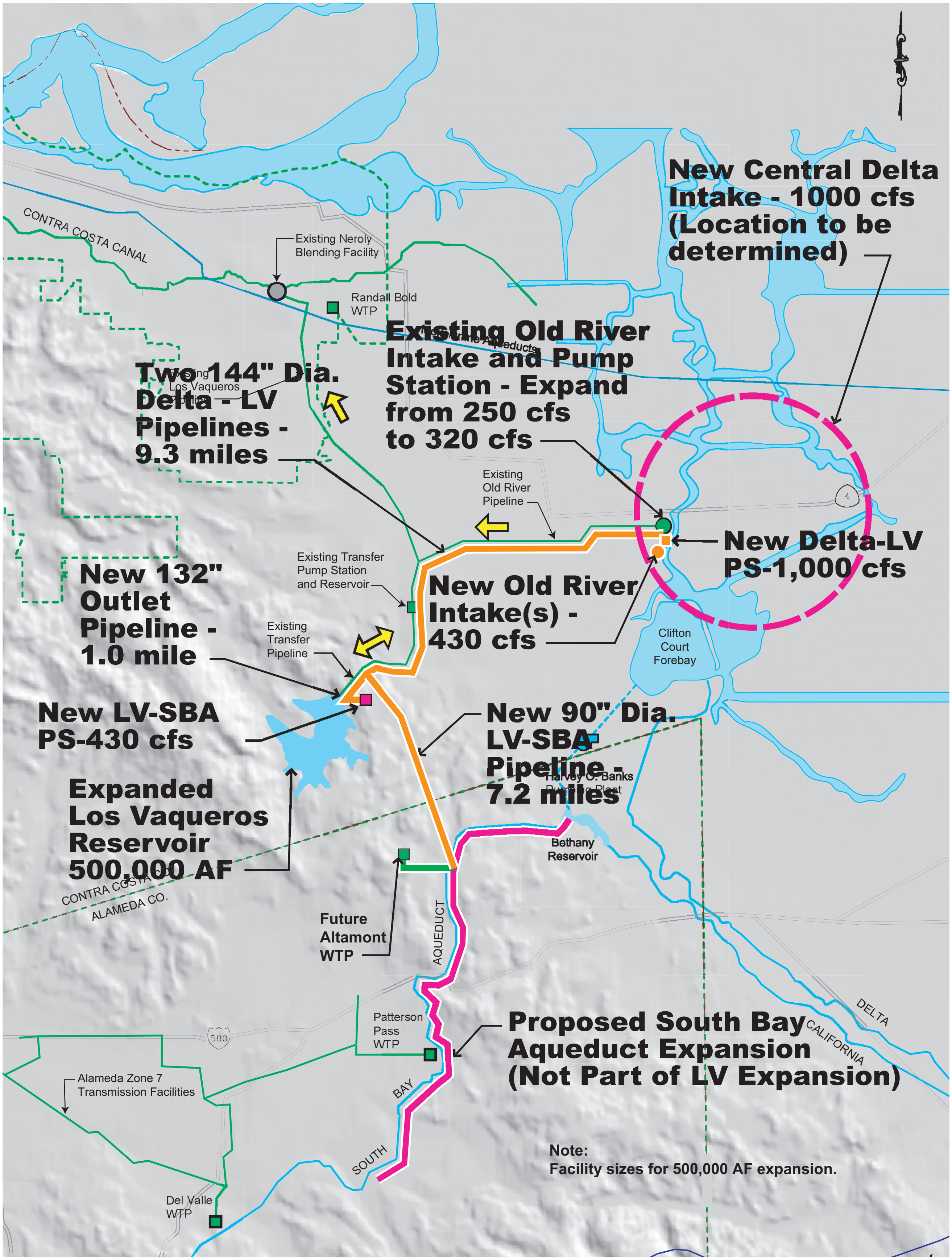
TABLE 3-5. Los Vaqueros Reservoir Expansion Potential Partner and Supply Amounts

Type of Benefit	*Potential Amount (AFY)*	*Notes/Issues*
CCWD		
Dry-year supply	10,000 AFY	Estimated in Los Vaqueros Reservoir Expansion Studies.
SBA Contractors (SCVWD, ACWD)		
Dry-year supply	32,000 AFY	Estimated in Los Vaqueros Reservoir Expansion Studies.
SFPUC(1)		
Dry-year supply	TBD	Details of potential SFPUC participation will be evaluated in future studies.
SBA Contractors (Zone 7, SCVWD, ACWD)		
Average year water quality potential improvement	121,000 of average annual deliveries of higher quality water to the SBA	Estimated in Los Vaqueros Reservoir Expansion Studies.

(1) For the purposes of this study, SFPUC includes retail customers and the 28 wholesale customers, BAWSCA member agencies.

3.2.2 Enhanced Conservation

Many of the participating agencies are already implementing aggressive water efficiency programs, including education and incentives for indoor technologies (e.g., commercial dishwashers, low flow pre-rinse spray nozzles, x-ray processor technology); education and incentives for new water efficient landscape technologies (e.g., self-adjusting ET based sprinkler timers, drought tolerant gardening); and pricing incentives (e.g., tiered rate structures). The Enhanced Conservation concept includes activities that are not currently projected to be cost-effective for participating agencies to implement individually within the study timeframe, as well as opportunities for regional cooperation to increase effectiveness of certain measures, including regional public outreach, research collaboration, regional efforts to standardize product labeling, Bay Area School sponsored Conservation Calendar, and regional collaboration on Demonstration Gardens and Bay Area Landscaping Guides. Measures included in the Enhanced Conservation Concept are above and beyond the projected 180,000 AFY of Bay Area conservation projects currently being planned by the year 2020, and include both local and regional initiatives.


New Central Delta Intake - 1000 cfs (Location to be determined)
CONTRA COSTA CANAL
Existing Neroly Blending Facility
Randall Bold WTP
Existing Old River Intake and Pump Station - Expand from 250 cfs to 320 cfs
Mokelumne Aqueducts
Two 144" Dia. Delta - LV Pipelines - 9.3 miles
Existing Los Vaqueros Pipeline
Existing Old River Pipeline
4
New Delta-LV PS-1,000 cfs
Existing Transfer Pump Station and Reservoir
New Old River Intake(s) - 430 cfs
New 132" Outlet Pipeline - 1.0 mile
Existing Transfer Pipeline
Clifton Court Forebay
New LV-SBA PS-430 cfs
New 90" Dia. LV-SBA Pipeline - 7.2 miles
Harvey O. Banks Pumping Plant
Bethany Reservoir
Expanded Los Vaqueros Reservoir 500,000 AF
CONTRA COSTA CO.
ALAMEDA CO.
Future Altamont WTP
AQUEDUCT
Patterson Pass WTP
580
Proposed South Bay Aqueduct Expansion (Not Part of LV Expansion)
DELTA
CALIFORNIA
BAY
SOUTH
Alameda Zone 7 Transmission Facilities
Del Valle WTP
Note:
Facility sizes for 500,000 AF expansion.

Legend

🟧 Los Vaqueros Expansion Facilities

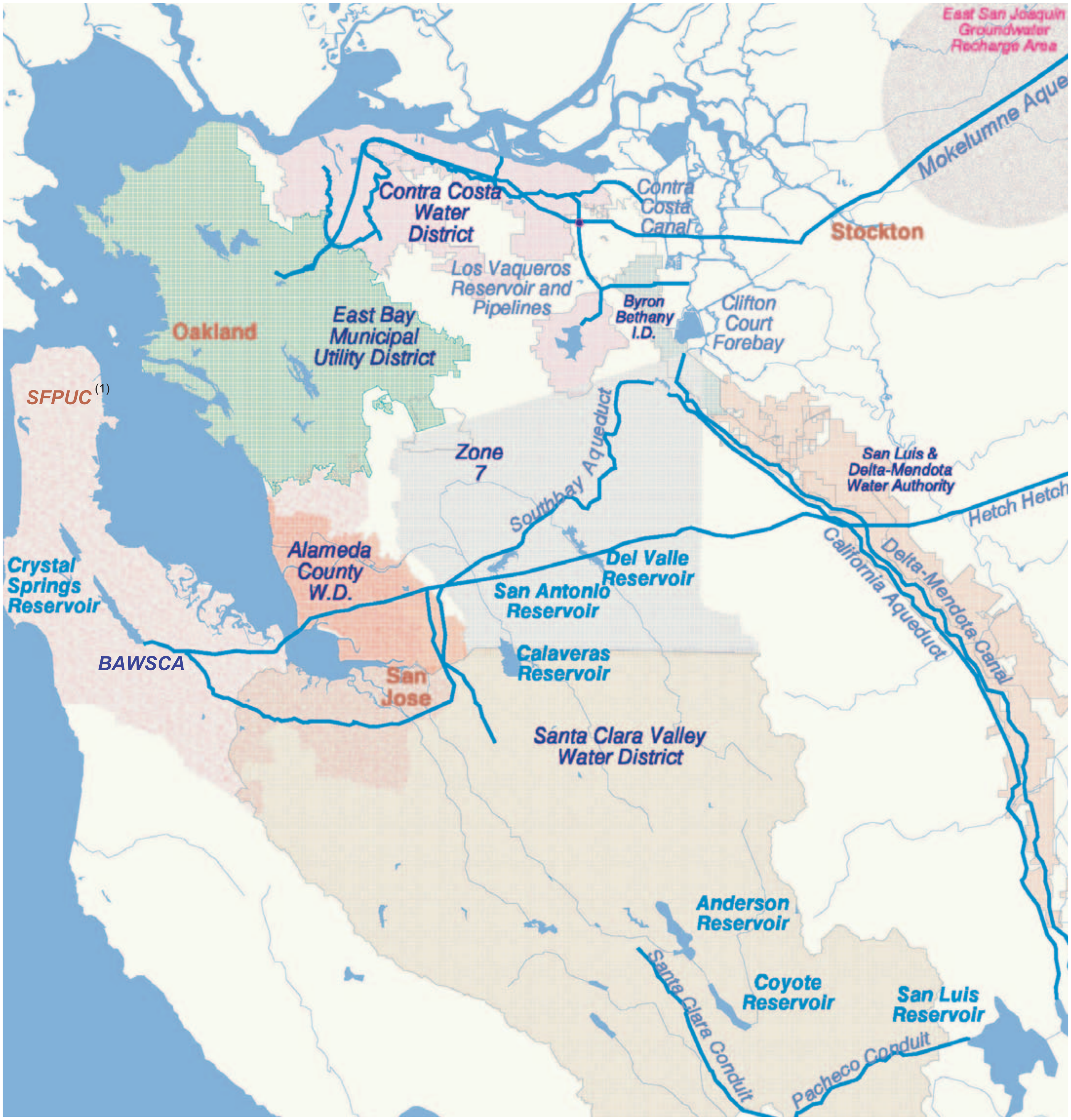
Figure 3-4

Los Vaqueros Reservoir Expansion Concept Facilities

Potential beneficiaries for the Enhanced Conservation concept are summarized in Table 3-6. Figure 3-5 displays the boundaries of the seven major Bay Area Water Agency service areas, the area where conservation is assumed to occur.

TABLE 3-6. Enhanced Conservation Potential Partner and Supply Amounts

Type of Benefit	Potential Amount (AFY)	Notes/Issues
All Program Participating Agencies		
Dry-year supply	Not quantified	Potential for reduced environmental impact associated with decreased construction of other water supply facilities may provide a benefit to the Bay Area as a whole.



(1) SFPUC also serves the 28 customers represented by BAWSCA, including ACWD.

Note: Figure courtesy of EBMUD.

Figure 3-5
Locations of Seven Bay Area Agencies

3.2.3 Water Recycling

Twenty-six water recycling concepts have been carried forward for detailed evaluated in the Program. These recycled water projects will provide up to 97,000 AFY of water for meeting non-potable demands, such as irrigation and industrial uses. This will result in a reduction in potable supply shortfalls, improving the supply reliability for the participating agencies. Potable supplies offset by the recycled water supply are assumed to meet demand, and are not available for exchange between agencies. As such, there is no water quality element associated with these concepts, and they provide benefit only for the owning agency.

Table 3-7 includes a summary of potential Water Recycling concepts, including projected supply quantities and beneficiaries. Figure 3-6 displays the locations of the potential Water Recycling concepts.

TABLE 3-7. Water Recycling Concepts

Project	Dry-Year Supply (AFY)	Potential Beneficiaries
ACWD-USD Recycled Water Feasibility Study Project, Phase I		
This project concept outlines Phase I of a proposal to construct a recycled water satellite treatment plant at the Irvington Wastewater Pump Station. Recycled water would be treated to Title 22 standards and distributed to users located in the southern and southwestern portions of the ACWD service area (e.g., the planned Newark Golf Course, the Pacific Commons Development and the planned Doublewood Golf Course).	1,650	ACWD, BAWSCA, SFPUC(1)
Burlingame Recycled Water Project		
The City of Burlingame is considering expanding recycled water production to 4 million gallons per day (MGD) (4,400 AFY) for unrestricted park landscaping and large landscaping uses involving customers located in the Bay-front area, including SFO.	4,400	BAWSCA, Burlingame, Millbrae, SFO, SFPUC(1)
Central Contra Costa Sanitary District (CCCSD)- Industrial Recycled Water Project		
This project would provide advanced treatment of recycled water for industrial use at the Tesoro Power Plant, Foster Wheeler cogeneration facility, the Equilon Refinery (formerly Shell Martinez) and Rhoida (formerly Rhone-Poulenc).	17,920	Tesoro, other industrial users, CCWD
CCCSD - Irrigation Recycled Water Project		
This concept describes the potential treatment and conveyance of recycled water for irrigation in North Concord and Walnut Creek. This concept proposes 3,000 AFY (North Concord: 1,000 AFY; Walnut Creek: 2,000 AFY) of recycled water for irrigation (CCCSD Staff, June 2004).	3,000	EBMUD, CCWD
Coastside County Water District Recycled Water Project		
This proposed concept project would provide up 580 AFY of recycled water supply from the Sewer Authority Mid-Coastside WWTP for irrigation uses at two golf courses in Ocean Colony and the Skylawn Memorial Park Cemetery (Carollo, 2003).	580	Coastside CWD, BAWSCA, Ocean Colony, Skylawn Memorial Park Cemetery
Expanded Delta Diablo Sanitation District (DDSD) Recycled Water Project		
This concept would provide 1,600 AFY of recycled water supply for urban landscape projects and irrigation uses in DDSD's service area. These potential users include the Pittsburg City Hall and various golf courses (Baatrup, 2004).	1,600	CCWD industrial and irrigation users

TABLE 3-7. Water Recycling Concepts

Project	*Dry-Year Supply (AFY)*	*Potential Beneficiaries*
Expanded DSRSD/EBMUD Recycled Water Authority (DERWA) Recycled Water Project		
DERWA is a Joint Powers Authority between Dublin San Ramon Services District (DSRSD) and EBMUD. This concept involves Phase II of the DSRSD portion of the San Ramon Valley Recycled Water Program (below), which will provide 1,430 AFY at a cost of $4.1 M. Phase II has not been financed and will depend on outside funding to proceed with planning and future construction.	1,430	EBMUD, DSRSD (Zone 7)
Expanded San Ramon Valley Recycled Water Project		
Phases II and III of the EBMUD San Ramon Valley Recycled Water Project will yield 1,094 AFY of recycled water to portions of Blackhawk, Danville, Dublin and San Ramon. Recycled water would be produced at the DERWA facilities and distributed to residential and industrial customers. Planning has begun for Phase II and Phase III, which could begin as soon as 2005 and 2008, respectively. Neither Phase II nor Phase III has been financed and the ambitious schedule would depend largely on obtaining funding relatively soon.	1,904	EBMUD, City of Blackhawk, City of Danville, City of Dublin, City of San Ramon
Expanded East Bayshore Recycled Water Project		
The second and third phases of the East Bayshore Project will provide 2,016 AFY recycled water to portions of Alameda, Albany, Berkeley, Emeryville and Oakland. Construction for Phase IB is expected to begin in 2009 and for Phase 2 in 2013. Neither Phase IB nor Phase 2 has been financed and therefore both are contingent upon securing additional funds.	2,016	EBMUD, City of Alameda, City of Albany, City of Berkeley, City of Emeryville, City of Oakland
Expanded South Bay Water Recycling (SBWR)		
This concept proposal involves implementing the remaining elements of the South Bay Water Recycling project that have not already been financed. Expansion of pipelines into Santa Clara and Milpitas, construction of the Silver Creek Pipeline into Coyote Valley (South San Jose) and additional reservoirs are all proposed for Phase II (SCVWD, 2004). The project overall cost of $208-$241 million does not include advanced treatment or expansion of the recycled water production facilities.	16,800	Santa Clara, San Jose, and Milpitas (SCVWD, SFPUC(1), BAWSCA)
Franklin Canyon Recycled Water Project		
Wastewater from the Pinole and Hercules treatment plants would be conveyed to a recycled water facility in the Hercules area and treated to produce 0.3 MGD (336 AFY). Recycled water would then be distributed to various users, potentially including the Tosco Carbon Plant, Franklin Canyon Golf Course, and a variety of other irrigation and industrial users in the area (EBMUD, 2004).	336	EBMUD
Lamorinda Recycled Water Project – Phase I		
This project would supply approximately 1 MGD (1,120 AFY) of recycled water to customers in areas of Walnut Creek, Pleasant Hill, Lafayette, Moraga and Orinda for landscape irrigation. The recycled water would be produced at CCCSD's Recycled Water Plant and distributed to golf courses, schools, parks, cemeteries, etc.	1,120	CCCSD, EBMUD
Livermore Agricultural Recycled Water Project		
This concept would expand the current use of the Livermore Wastewater Reclamation Plant (LWRP) by 2,660 AFY to supply vineyards in the Livermore area (Brown and Caldwell, 2003).	2,660	Livermore (Zone 7)
Livermore Municipal Recycled Water Project		
This project would increase the demand for recycled water from the LWRP to 5 MGD (representing an increase of up to 2,800 AFY) by expanding the existing irrigation customer base to developments located north of I-580 (Greenwood, 2004).	2,240 – 2,800	Livermore (Zone 7)

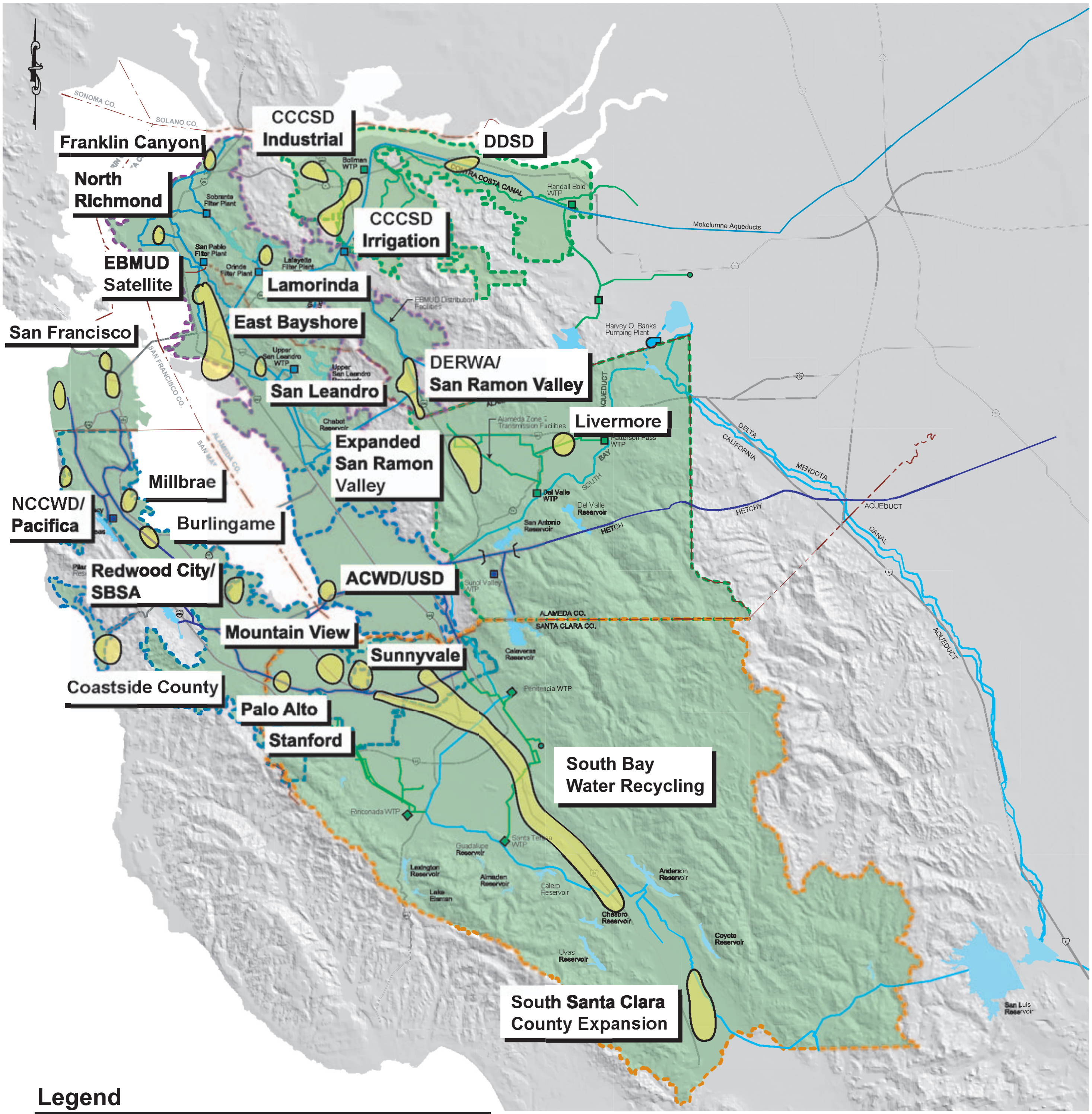
TABLE 3-7. Water Recycling Concepts

Project	Dry-Year Supply (AFY)	Potential Beneficiaries
Millbrae Recycled Water Project		
The City of Millbrae has considered expanding their recycled water production by upgrading the existing Millbrae WWTP to produce 1.0 MGD of tertiary treated recycled water for unrestricted use (RMC, 2003). Recycled water would be conveyed from the Millbrae WWTP to customers located in Millbrae and adjacent areas of San Bruno, Burlingame and SFO.	1,120	Millbrae, San Bruno, and Burlingame (BAWSCA, SFPUC(1)); SFO (SFPUC(1))
NCCWD/Pacifica Recycled Water Project		
The North Coast County Water District (NCCWD), in a partnership with SFPUC, has developed a program to make recycled water available to the San Francisco-owned golf course in Pacifica, the Sharp Park Golf Course, and also extending recycled water to the Jefferson Unified School District, the City of Pacifica, and CalTrans for Highway 1 irrigational uses, and other potential irrigation customers (RMC, 2003, Kennedy/Jenks, 2001, BAWSCA, 2004).	225	NCCWD, BAWSCA, SFPUC(1)
North Richmond Expansion Recycled Water Project		
The West County Wastewater District currently provides secondary treated wastewater effluent to the North Richmond Water Reclamation Plant, owned by EBMUD, for tertiary treatment. This project involves the production of 4 MGD of recycled water. Existing treatment facilities would be used to serve 1 MGD to a fourth cooling tower at the Chevron Texaco refinery and irrigation customers. The project would also involve the construction of additional advanced treatment facilities to serve 3 MGD to ChevronTexaco for boiler feed water.	4,480	EBMUD
Palo Alto Recycled Water Projects		
The Palo Alto recycled water concept would entail the production of 1,830-4,677 AFY of recycled water at the Palo Alto Regional Water Quality Control Plant (RWQCP) for distribution within the local service area for irrigation and commercial/industrial uses.	1,830 – 4,677	BAWSCA, Palo Alto, East Palo Alto, Stanford University, Mountain View, Los Altos/Los Altos Hills, SFPUC(1)
Palo Alto RWQCP – Mountain View Recycled Water Project		
The Palo Alto RWQCP– Mountain View recycled water project would entail the production of recycled water at the Palo Alto RWQCP for distribution to portions of Palo Alto, the Mountain View Shoreline Area and Moffett Field for irrigation and industrial usage.	1,480 – 1,860	BAWSCA, Palo Alto, Mountain View, Moffett Field, SFPUC(1)
Redwood City/SBSA Recycled Water Project		
This concept would involve the production up to 3,238 AFY of recycled water at the South Bayside System Authority (SBSA) WWTP, for distribution to customers in Redwood Shores, the greater Bay-front area, and Central Redwood City areas of Redwood City for irrigation, industrial and other non-potable uses. There is also potential to expand the project to serve adjacent communities (Kennedy/Jenks, 2002).	1,960	BAWSCA, Redwood City, San Carlos, Belmont, SFPUC(1)
San Francisco Recycled Water Project		
The City and County of San Francisco is currently preparing a Recycled Water Master Plan Update to provide guidance for the implementation of recycled water projects in the City. The Recycled Water Master Plan Update builds upon recycled water plans and studies conducted in the City in the 1990s. It will consider new technologies as well as potential new markets for recycled water. The draft Plan is scheduled to be completed in the summer of 2005. The final Plan including the CEQA review process will be completed in 2006, so that construction of recycled water projects can begin.	Up to 19,000	SFPUC(1)

TABLE 3-7. Water Recycling Concepts

Project	*Dry-Year Supply (AFY)*	*Potential Beneficiaries*
San Leandro Recycled Water Project		
The San Leandro Reclamation (SLR) Facility would expand production of recycled water by upgrading the SLR Facility to provide existing customers with tertiary-treated water and an additional 0.5 MGD (560 AFY) of tertiary-treated water to potential irrigation, industrial and commercial customers (EBMUD, 2004).	1,060	San Leandro (EBMUD)
Satellite EBMUD Recycled Water Project		
EBMUD has initiated a study to determine the feasibility of constructing satellite WWTPs within the District water service area. This project concept involves the design and construction of a pilot demonstration plant for feasible customers. The University of California, Berkeley could potentially be a partner in the project, and the pilot demonstration plant could possibly be located at the university to serve some of its irrigation demand. Additional satellite WWTP projects could potentially follow a successful pilot demonstration project.	20	EBMUD
South Santa Clara Water Recycling		
The South County Water Recycled Water project concept details the improvements planned for recycled water program of SCVWD, South County Regional Wastewater Authority, and the City of Gilroy. These improvements include construction of two 3-MGD pump stations, construction of two 3-MGD storage reservoirs and the installation of 27,000 feet of distribution pipeline.	1,800	SCRWA, SCVWD, City of Gilroy
Stanford University Recycled Water Project		
Stanford University is considering three recycled water projects: capturing on-campus wastewater sources that are initially discharged to the campus sewer system before being discharged to the Palo Alto RWQCP (up to 644 AFY); capturing on-campus and additional nearby off-campus wastewater sources from Stanford University facilities that currently discharge to the Palo Alto RWQCP (up to 1,094 AFY); and sharing part of the capital costs for Palo Alto's Regional Recycling Project and purchasing the RWQCP's recycled water, see discussion of the Palo Alto Recycled Water Project (up to 1,800 AFY).	72 – 1,094	Palo Alto, SFPUC(1), SCVWD, BAWSCA
Sunnyvale Recycled Water Project		
This project involves the expansion of recycled water use within the service area of Sunnyvale's Water Pollution Control Plant for irrigation and other purposes. This project would provide recycled water to potential users that are already connected to the recycled water system. It may be possible to extend the distribution to new users if additional funding is secured.	1,470	BAWSCA, Sunnyvale, SFPUC(1)

(1) For the purposes of this study, SFPUC includes retail customers and the 28 wholesale customers, BAWSCA member agencies.



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🟨 Recycling Area

🟩 Potential Dry Year Yield Beneficiaries

Figure 3-6

Locations of Potential Water Recycling Concepts

CDM

3.2.4 Desalination

Five desalination concepts were carried forward for detailed evaluation: the Regional Desalination Project, Mirant Pittsburg or Antioch Desalination with Water Quality Element, Near Bay Bridge Desalination with Water Quality Element, South Bay Desalination Concepts, and East Bay Saline Groundwater Desalination.

3.2.4.1 Regional Desalination Project

The Bay Area Regional Desalination Project is intended to improve supply reliability for the residents and businesses served by partner agencies by developing a desalination plant, or plants, at a site, or sites, that will provide benefit, either directly or indirectly, to each of the agencies that choose to participate. Regional partners sponsoring this study are CCWD, EBMUD, SFPUC and SCVWD.

The RDP could potentially provide an additional source of water during emergencies, provide supplemental supply during extended drought periods, allow increased flexibility in taking other facilities offline for repairs, or provide a full-time, all weather supplemental supply, increasing the diversity of supplies for the partner agencies. The RDP would provide up to 120 MGD product water at one or multiple sites. All partners are intended to benefit from the facility, either through receiving desalinated water directly, or by receiving water from another agency that receives desalinated water.

In its initial phase, the Regional Desalination Study explored thirteen potential desalination locations, and evaluated the sites based on seven criteria: feedwater quality, cost of product water, permitting/water rights requirements, public acceptance/socioeconomic effects, potential for grant funding, capability of supplying multiple agencies, environmental effects. Three potential desalination sites were identified for further evaluation in subsequent phases of the Study: Mirant Pittsburg Plant (co-located with the Mirant Pittsburg Power Plant in Pittsburg, California), Oceanside, San Francisco (located in the western part of San Francisco, possibly adjacent to the existing Oceanside wastewater treatment plant), and Near Bay Bridge (located in close proximity to EBMUD's wastewater treatment plant in Oakland, on the eastern side of the Bay Bridge). This initial phase evaluated these three sites and developed projected cost estimates assuming year-round operation in all years. Details of operation, as well as benefits and/or impacts to the RDP partners, will be developed in future phases of that project.

Potential beneficiaries, supply quantities, and potential sites for the Regional Desalination Project concept are summarized in Table 3-8 and Figure 3-7. Note that while not a member of the RDP, ACWD has expressed interest in potential participation in any future RDP desalination projects.

TABLE 3-8. Regional Desalination Project Potential Partner and Supply Amounts

Type of Benefit	*Potential Amount (AFY)*	*Notes/Issues*
SFPUC[(1)], SCVWD, CCWD, EBMUD		
Dry-year supply reliability	TBD by RDP	

(1) For the purposes of this study, SFPUC includes retail customers and the 28 wholesale customers, BAWSCA member agencies.

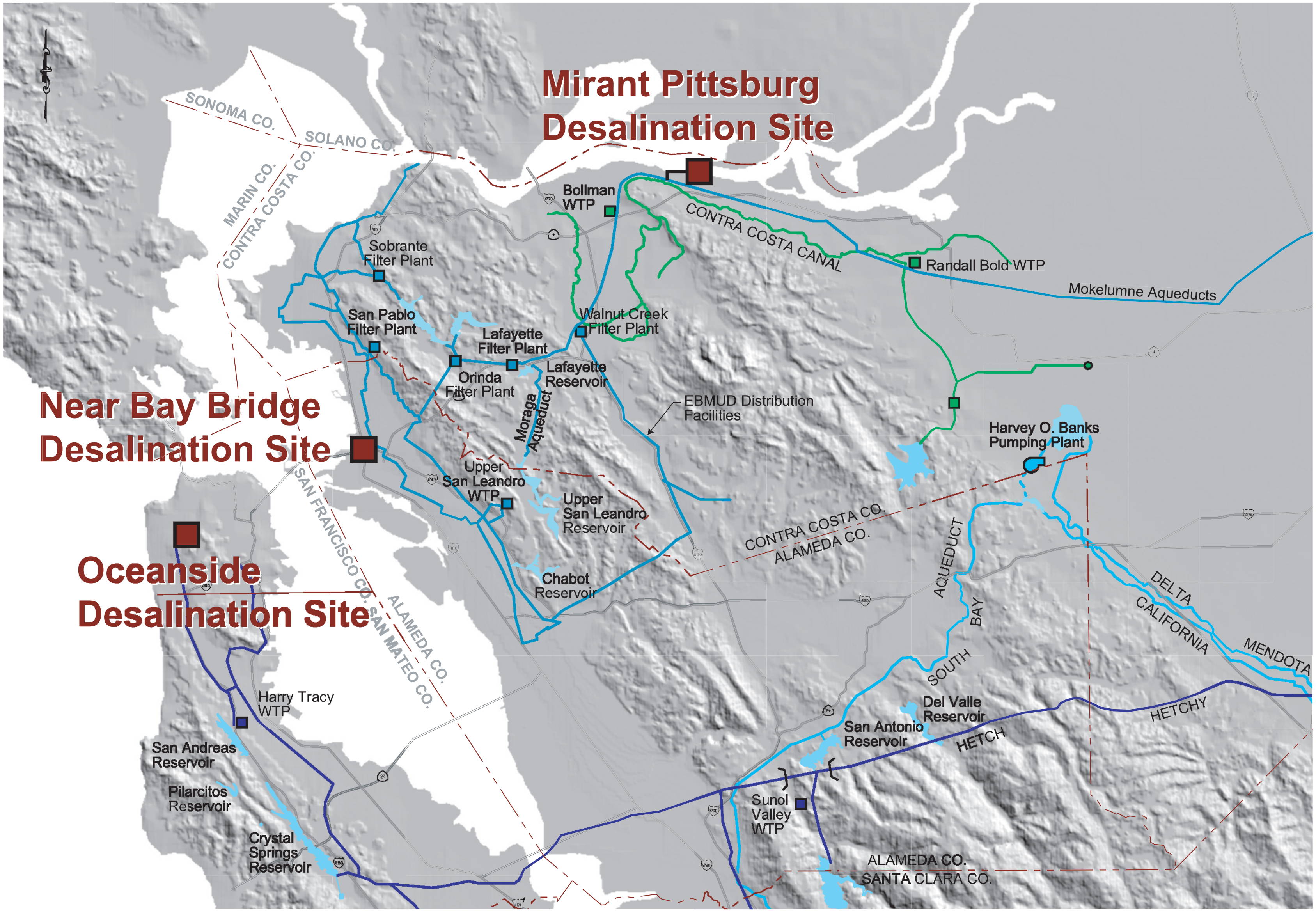

Figure 3-7

Regional Desalination Project Potential Sites

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3.2.4.2 Mirant Pittsburg or Antioch Desalination with Water Quality Element

The Mirant Desalination with Water Quality Element concept would involve co-location of an up to 40 MGD desalination plant at either the Mirant Pittsburg Power Plant, in Pittsburg, or the Mirant Contra Costa Power Plant in Antioch. This concept is a variation on the project described in the Bay Area Regional Desalination Project Pre-Feasibility Study (RDP PFR, 2003), and is dependent upon selection of the Mirant Pittsburg or Antioch site for a desalination facility by the RDP. This concept has not been evaluated by the Regional Desalination Project. In contrast to the RDP, which evaluated this location principally for dry-year supply for the four regional partners (CCWD, EBMUD, SFPUC & SCVWD), the BAWQ&SRP is evaluating the potential to also provide average year water quality benefits to interested agencies, including those who are not currently partners in the RDP. As with all concepts, additional analysis will be required to address potential environmental, water rights, institutional, cost-sharing and other issues if this concept appears feasible.

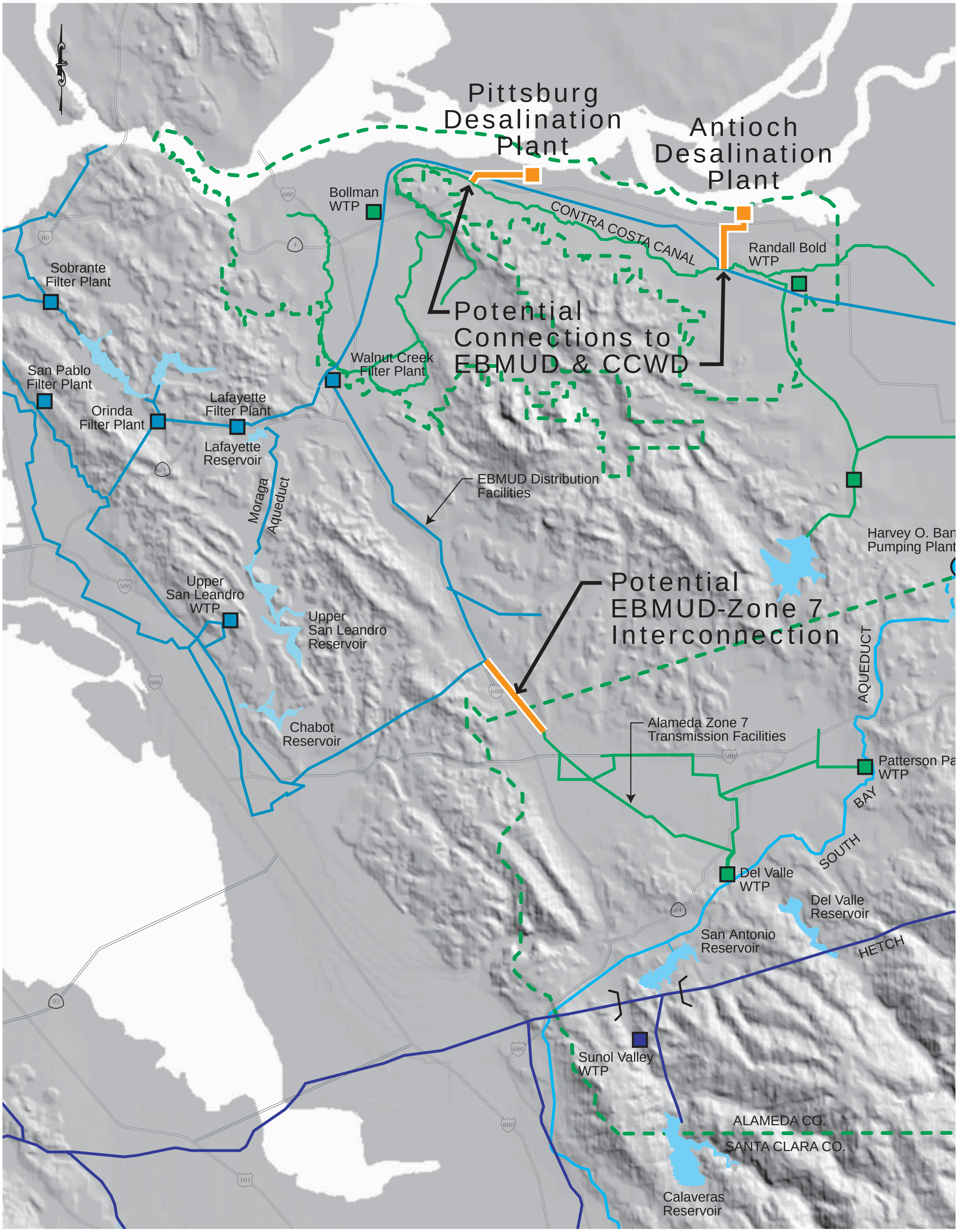
The Bay Area agency potentially interested in this concept is the Zone 7 Water Agency. Supply from the Mirant Desalination with Water Quality Element concept would potentially be conveyed through the EBMUD Mokelumne Aqueduct, treated and conveyed through the distribution system, for delivery to Zone 7, via a new intertie connecting EBMUD's San Ramon Valley system with Zone 7 transmission facilities. This water could be used directly by the Zone 7 retail customers, or injected into the groundwater basin. This concept assumes that water delivered to Zone 7 would be either State Water Project water diverted at Pittsburg or Mirant Pittsburg or Antioch desalinated water purchased by Zone 7. Use of either SWP water or other supplies may require modification of existing water rights or acquisition of new water rights by Zone 7. This study assumed an intertie size of up to 25 MGD, with a potential annual transfer of up to 15,000 acre-feet during winter months in average or wet hydrologic years, based on estimates of available capacity in the EBMUD system. Additional study would be required to determine whether capacity is continuously available in the EBMUD system.

Potential beneficiaries, supply quantities, and conceptual facilities for the Mirant Pittsburg or Antioch Desalination with Water Quality Element concept are summarized in Table 3-9 and Figure 3-8.

TABLE 3-9. Mirant Pittsburg or Antioch Desalination with Water Quality Element Potential Partner and Supply Amounts

Type of Benefit	Potential Amount (AFY)	Notes/Issues
CCWD		
Dry-year supply reliability (through RDP)	TBD by RDP	The Mirant Desalination facility could be sized to produce up to 43,000 AFY. Deliveries could be made via the Multi-purpose Pipeline (MPP) (treated). The MPP has a capacity of 25 MGD. CCWD could also deliver up to 40 MGD to the Contra Costa Canal (untreated). Specific plant locations, allocations or exchange between EBMUD and CCWD or with other partner agencies will be determined as part of the Regional Desalination Project.
EBMUD		
Dry-year supply reliability (through RDP)	TBD by RDP	The Mirant Desalination facility could be sized to produce up to 43,000 AFY. Deliveries could be made via the Mokelumne Aqueduct (untreated). Water would be re-treated at EBMUD's Walnut Creek, Lafayette and/or Orinda water treatment plants (WTPs). Specific plant locations, allocations or exchange between EBMUD and CCWD or with other partner agencies will be determined as part of the Regional Desalination Project.
SFPUC(1)		
Dry-year supply reliability (through RDP)	TBD by RDP	All RDP partners will benefit from the desalination facility in dry years. The quantity and operations will be determined in future phases of the RDP process.
SCVWD		
Dry-year supply reliability (through RDP)	TBD by RDP	All RDP partners will benefit from the desalination facility in dry years. The quantity and operations will be determined in future phases of the RDP process.
Zone 7		
Average Year Water Quality (BAWQ&SRP concept)	Up to 15,000 AFY	Deliveries via new 25 MGD connection during November through March between EBMUD and Zone 7, for direct delivery for blending, or for storage in groundwater basin for subsequent extraction.

(1) For the purposes of this study, SFPUC includes retail customers and the 28 wholesale customers, BAWSCA member agencies.



Legend

▬ Potential Pipeline Alignment

Figure 3-8
Mirant Antioch or Pittsburg Desalination with Water Quality Element Regional View

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3.2.4.3 Near Bay Bridge Desalination with Water Quality Element

The Near Bay Bridge Desalination with Water Quality Element concept would involve location of a desalination plant near the EBMUD Regional Wastewater Treatment Plant, located in Oakland at the eastern end of the Bay Bridge. The plant could be sized up to 40 MGD. According to EBMUD, there is insufficient space at the WWTP for addition of a desalination facility. Implementation of this concept would require the acquisition of additional property from the Port of Oakland or at the former Oakland Army Base. This concept is a variation on the project described in the RDP PFR, and is dependent upon selection of the Near Bay Bridge site for a desalination facility by the RDP. This concept has not been evaluated by the Regional Desalination Project. In contrast to the RDP, which evaluated this concept principally for dry-year supply for the four regional partners, the BAWQ&SRP is evaluating the potential to also provide average year water quality benefits to interested agencies, including those who are not currently partners in the RDP. As with all concepts, additional analysis will be required to address potential environmental, institutional, cost-sharing and other issues if this concept appears feasible.

The Zone 7 Water Agency is potentially interested in this concept as a potential partner. Supply from the Near Bay Bridge Desalination with Water Quality Element concept would potentially be conveyed through the EBMUD distribution system, for delivery to Zone 7. This water could be used directly by the Zone 7 retail customers, or injected into the groundwater basin. This concept assumes that water delivered to Zone 7 would be either State Water Project water diverted at the Near Bay Bridge location or Near Bay Bridge Desalinated water purchased by Zone 7. Use of either SWP water or other supplies may require modification of existing water rights or acquisition of new water rights by Zone 7. Water could be delivered through existing interconnections to Zone 7 customer Dublin-San Ramon Services District, or from the Southern Loop through EBMUD's East of Hills (EOH) San Ramon Valley system via a new interconnection to Zone 7. This study assumed an intertie size of up to 20 MGD, with a potential annual transfer of up to 10,000 acre-feet in average or wet hydrologic years.

Potential beneficiaries, supply quantities, and conceptual facilities for the Near Bay Bridge Desalination with Water Quality Element concept are summarized in Table 3-10 and Figure 3-9.

TABLE 3-10. Near Bay Bridge Desalination with Water Quality Element Potential Partner and Supply Amounts

Type of Benefit	*Potential Amount (AFY)*	*Notes/Issues*
CCWD		
Dry-year supply reliability (through RDP)	TBD by RDP	All RDP partners will benefit from the desalination facility in dry years. The quantity and operations will be determined in future phases of the RDP process.
EBMUD		
Dry-year supply reliability (through RDP)	TBD by RDP	The Near Bay Bridge facility could be sized to deliver up to 43,000 AFY. EBMUD could receive dry-year supply for its West of Hills (WOH) System. Specific plant locations, allocations or exchange with other partner agencies will be determined as part of the Regional Desalination Project. All RDP partners will benefit from the desalination facility in dry years. The quantity and operations will be determined in future phases of the RDP process.
SFPUC(1)		
Dry-year supply reliability (through RDP)	TBD by RDP	All RDP partners will benefit from the desalination facility in dry years. The quantity and operations will be determined in future phases of the RDP process.
SCVWD		
Dry-year supply reliability (through RDP)	TBD by RDP	All RDP partners will benefit from the desalination facility in dry years. The quantity and operations will be determined in future phases of the RDP process.
Zone 7		
Average Year Water Quality (BAWQ&SRP concept)	Up to 10,000 AFY	Deliveries via new connection between EBMUD and Zone 7, for direct delivery for blending. Transfers are limited due to hydraulic capacity constraints in the EBMUD distribution system.

(1) For the purposes of this study, SFPUC includes retail customers and the 28 wholesale customers, BAWSCA member agencies.

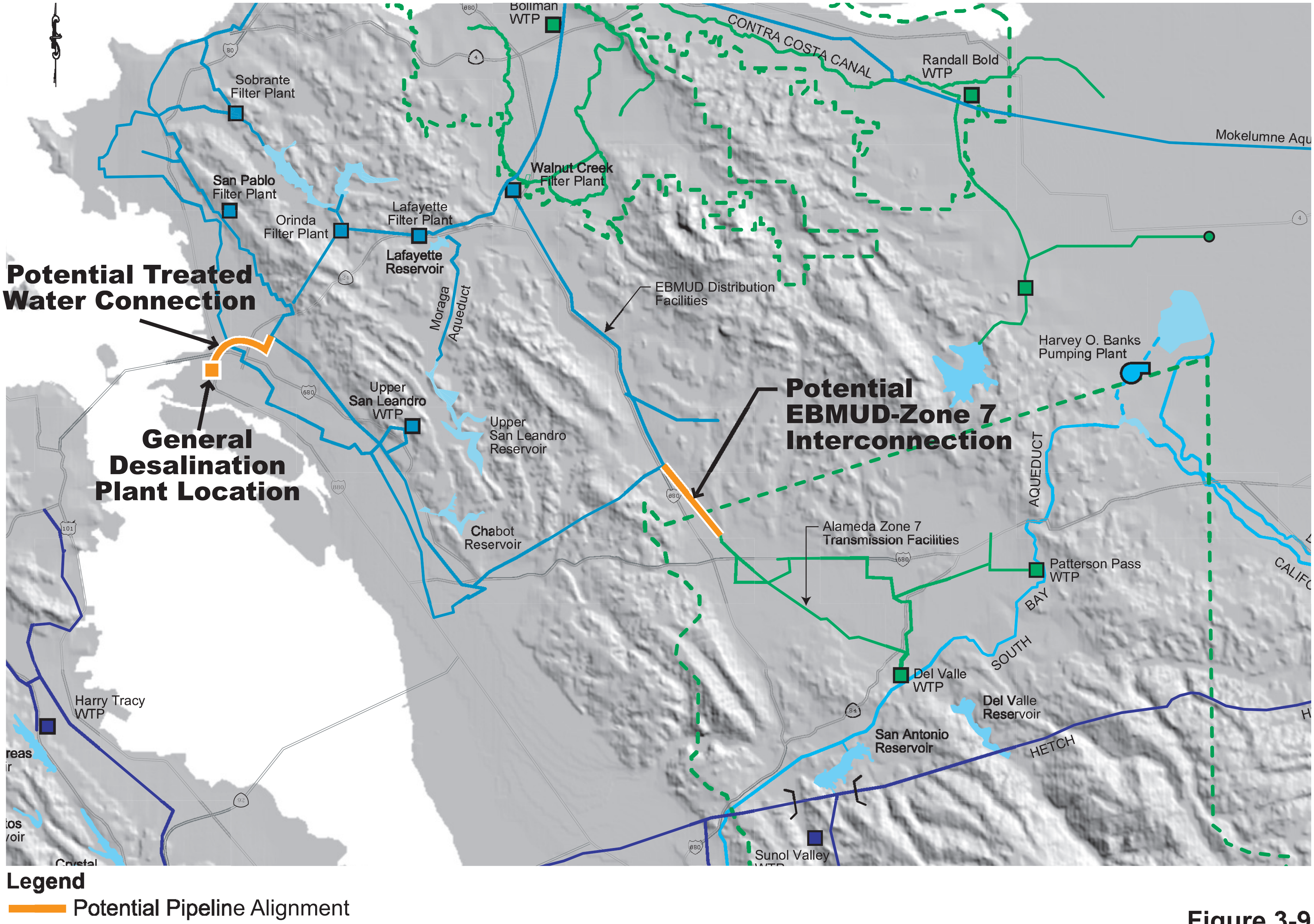

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Figure 3-9
Near Bay Bridge Desalination with Water Quality Element Regional View

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3.2.4.4 South Bay Desalination Concepts

The South Bay Desalination concepts would involve construction of up to three desalination plants in Santa Clara County treating brackish groundwater extracted from the upper aquifer for either potable or irrigation and/or industrial cooling end uses. The upper aquifer is currently only used for small local domestic or agricultural purposes, or for chemical contamination remediation projects. Three potential sites have been identified: Pico Power Plant in Santa Clara, Los Esteros Power Plant in San Jose, and the Palo Alto Regional Water Quality Control Plant in Palo Alto. Each of these plants is assumed to have a treated water capacity of up to 4 MGD for potable uses, or up to 1 MGD for irrigation and/or industrial uses.[2]

These concepts were evaluated in the RDP PFR that evaluated potential regional desalination plant sites to provide drought and emergency supply. The South Bay Desalination concepts received only a preliminary evaluation in the regional study and were not carried forward in the detailed cost and operational analysis because of their small capacity. As capacity is not a constraint for BAWQ&SRP, these concepts were retained for further analysis by this Program. As with all concepts, additional analysis will be required to address potential environmental, water rights, institutional and other issues if this concept appears feasible.

Potential participants are the Cities of Palo Alto, Santa Clara, and San Jose, which are BAWSCA member agencies and SFPUC/SCVWD common customers. The total available dry-year supply for the concept is up to 13,800 AFY of potable supply, or up to 3,200 AFY of irrigation and/or industrial cooling supply, based on three plants of 5 MGD intake (potable end-use) or 1 MGD treated water production (non-potable end-use) each and with plants operating 95 percent of the time. A facility located at the Palo Alto Regional WQCP site could provide Palo Alto with up to 4,600 AFY of potable, or 1,060 AFY of non-potable dry-year supply, potentially freeing up SFPUC potable supply for delivery to other SFPUC wholesale or retail customers if the supply is not needed to meet demands in the City of Palo Alto. A facility sited at the Pico Power Plant in Santa Clara could potentially provide up to 4,600 AFY of potable, or 1, 060 AFY of non-potable, dry-year supply for Santa Clara, freeing up either SCVWD or SFPUC potable water for delivery to other customers if the supply is not needed to meet demands in the City of Santa Clara. A facility cited at Los Esteros Power Plant, located within the North San Jose/Alviso service area of the San Jose Municipal Water System (SJMWS) could also potentially provide up to 4,600 AFY of potable, or 1, 060 AFY of non-potable dry-year supply to offset use of groundwater or SFPUC purchases by SJMWS, increasing local groundwater dry-year yields, or freeing up potable water for delivery to other SFPUC wholesale or retail customers if the supply is not needed to meet demands in SJMWS.

Potential beneficiaries, supply quantities, and potential sites for the South Bay Desalination concepts are summarized in Table 3-11 and Figure 3-10.

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[2] Irrigation treated water capacity sized to meet assessed demand for nonpotable supply. Potable treated water capacity based on maximum groundwater extraction of 5 MGD per facility.

TABLE 3-11. South Bay Desalination Concepts Potential Partner and Supply Amounts

Type of Benefit	Potential Amount (AFY)	Notes/Issues
City of Palo Alto (SCVWD, SFPUC(1), BAWSCA)		
Dry Year Supply Reliability	Up to 4,300 AFY (potable) Up to 1,000 AFY (irrigation/industrial)	No average year water quality benefit because Palo Alto receives high quality SFPUC water.
City of Santa Clara (SCVWD, SFPUC(1), BAWSCA)		
Dry Year Supply Reliability	Up to 4,300 AFY (potable) Up to 1,000 AFY (irrigation/industrial)	Average year water quality benefit likely only applies if desalinated water has a higher water quality than Santa Clara's groundwater or SCVWD supplies, and is cost-competitive.
Average Year Water Quality	Up to 4,300 AFY (potable)	
San Jose Municipal Water System (SCVWD, SFPUC(1), BAWSCA)		
Dry Year Supply Reliability	Up to 4,300 AFY (potable) (Up to 1,000 AFY irrigation/industrial)	Average year water quality benefit likely only applies if desalinated water has a higher water quality than SJMWS's groundwater supply and is cost-competitive.
Average Year Water Quality	Up to 3,700 AFY (potable)	

(1) For the purposes of this study, SFPUC includes retail customers and the 28 wholesale customers, BAWSCA member agencies.

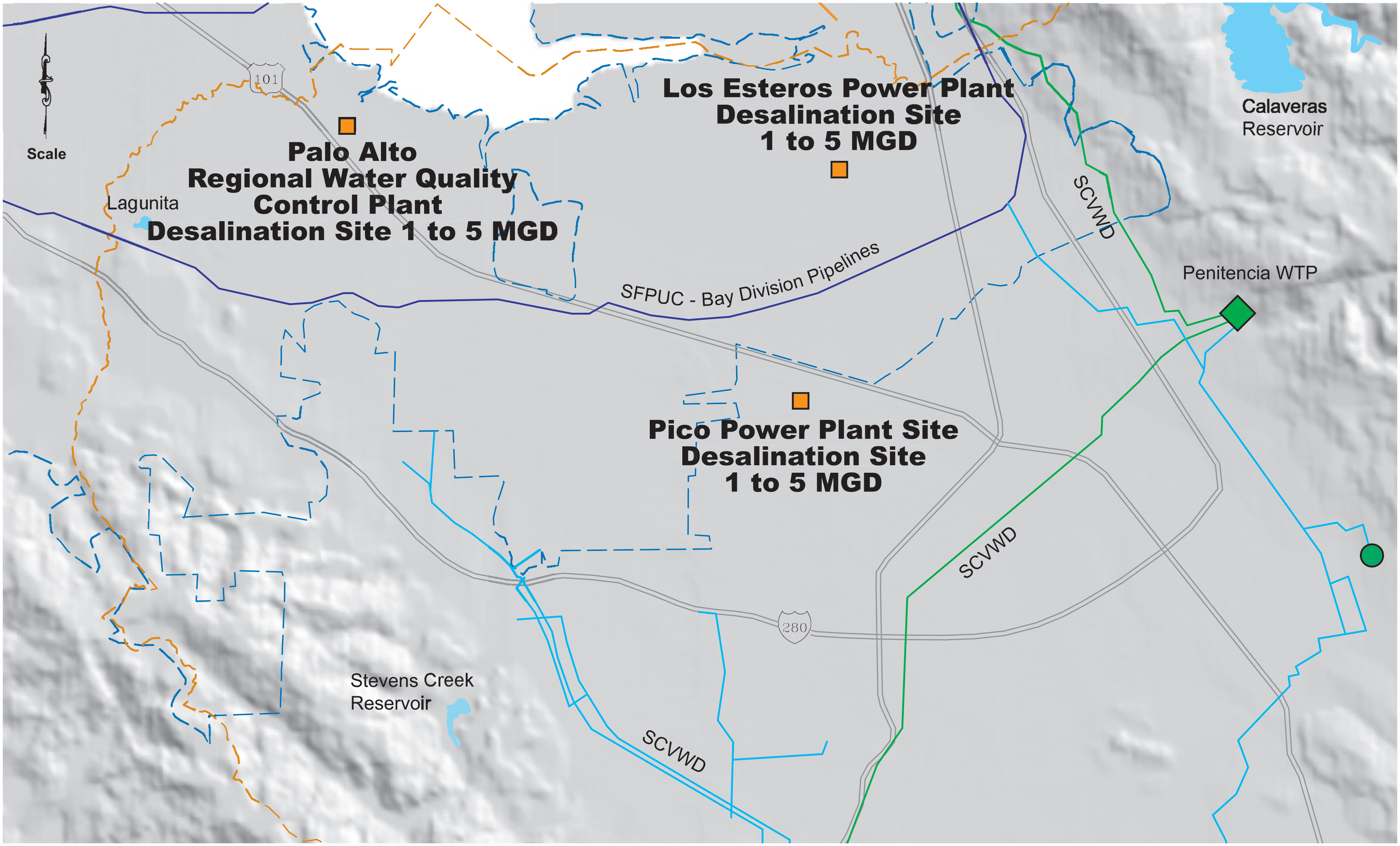

Figure 3-10
South Bay Desalination Concepts - Potential Sites

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3.2.4.5 East Bay Saline Groundwater Desalination

The East Bay Saline Groundwater Desalination Facility would involve location of a 10 to 15 MGD (treated production capacity) desalination plant in Newark or Fremont, California, for the purpose of desalinating non-potable, saline water from the saline portion of the Newark Aquifer.

Water would be extracted through a series of bay-shore perimeter wells within Alameda County Water District's service district area. Finished water could be pumped directly into ACWD's distribution system or into SFPUC's Bay Division Pipelines 1& 2 in its regional transmission system. Concentrate discharge could potentially be disposed of by delivering it to the East Bay Discharge Authority (EBDA) discharge pipeline, several miles north of the project area, or other options to be identified and evaluated during project planning. SCVWD has expressed interest in potentially partnering in this project. Details of SCVWD participation will be developed in future studies.

Potential beneficiaries, supply quantities, and the general location of the East Bay Saline Groundwater Desalination concept are summarized in Table 3-12 and Figure 3-11.

TABLE 3-12. East Bay Saline Groundwater Desalination Potential Partner and Supply Amounts

Type of Benefit	*Potential Amount (AFY)*	*Notes/Issues*
SFPUC[1]		
Dry Year Supply Reliability	Up to 16,000 AFY	Deliveries via the Bay Division Pipelines 1&2.
ACWD		
Dry Year Supply Reliability	Up to 16,000 AFY	Deliveries via direct connection to ACWD facilities.
Average Year Water Quality	Up to 16,000 AFY	
SCVWD		
Dry Year Supply Reliability	TBD	To be determined in future studies.
Average Year Water Quality	TBD	

[1] For the purposes of this study, SFPUC includes retail customers and the 28 wholesale customers, BAWSCA member agencies.

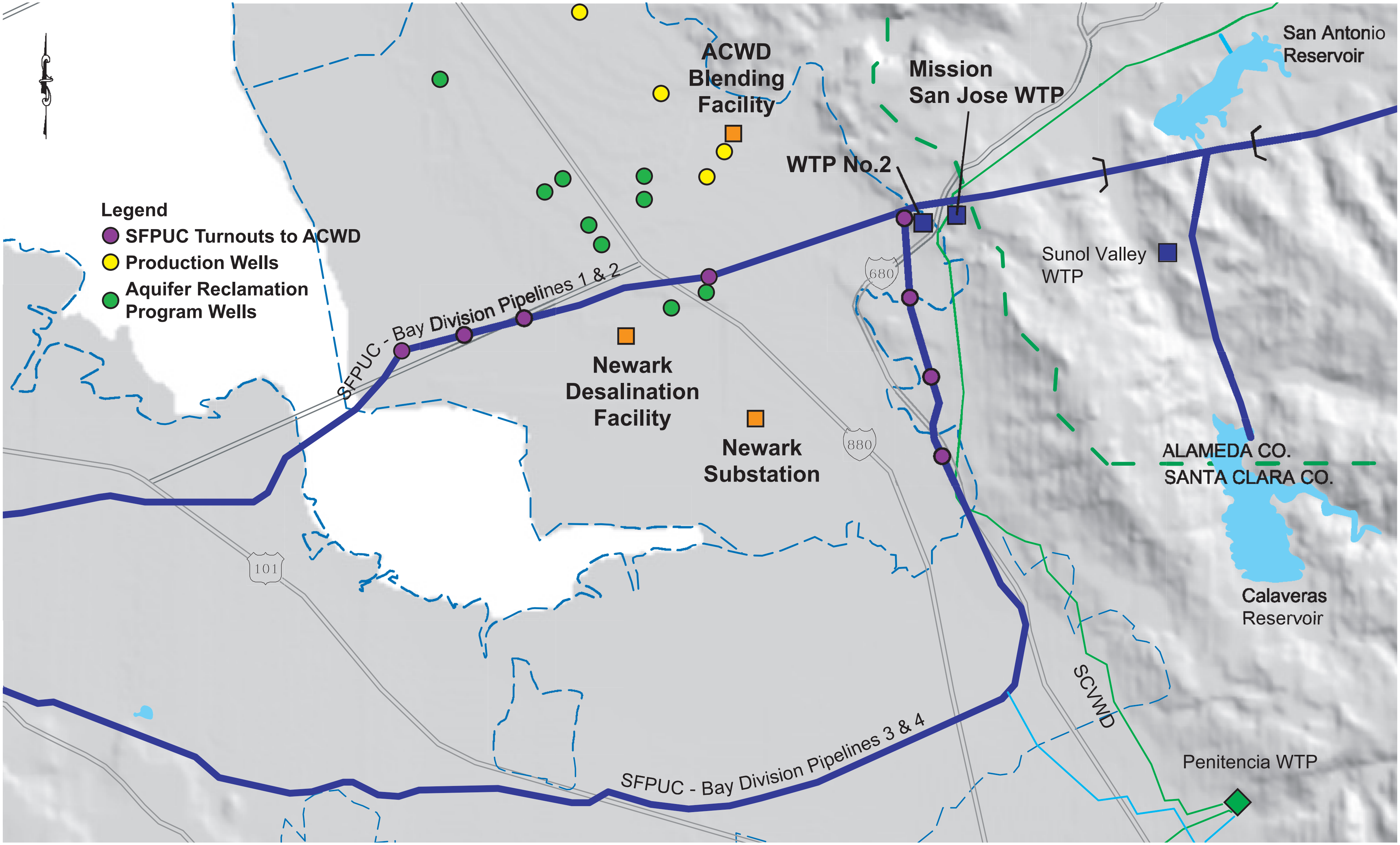

Figure 3-11
East Bay Saline Groundwater Desalination - General Area Map

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3.2.5 Conveyance

The Bay Area Use of the Freeport Regional Water Project was the only conveyance concept carried forward for detailed evaluation.

3.2.5.1 Bay Area Use of the Freeport Regional Water Project

EBMUD and Sacramento County Water Agency have formed a Joint Powers Authority called the Freeport Regional Water Authority to implement the Freeport Regional Water Project. The project would provide up to 100 MGD of dry-year supply for EBMUD from a new diversion located on the Sacramento River near Freeport. New pipelines would convey water from the Sacramento River to the Folsom South Canal, and from the canal to the EBMUD Mokelumne Aqueducts. The Final Environmental Impact Report for the Freeport Project was released in March 2004 and certified in April 2004. The Environmental Impact Statement was certified in January of 2005.

The Bay Area Regional Water Quality and Supply Reliability Program is evaluating the potential regional use of the Freeport facilities during average and wet years to convey water to other interested Bay Area water agencies. Additional analysis will be required to address potential environmental, water rights, institutional and other issues if this concept appears feasible.

The Bay Area Agency potentially interested in this concept is the Zone 7 Water Agency. The Bay Area Use of Freeport Regional Project would potentially divert water from the Sacramento River and convey it through the Freeport facilities, Mokelumne Aqueduct and EBMUD distribution system, for delivery to Zone 7. This water could be used directly by the Zone 7 retail customers, or injected into the groundwater basin. This concept assumes that water delivered to Zone 7 would be either State Water Project water diverted at Freeport or Sacramento River water purchased by Zone 7. Use of either SWP water or other supplies may require modification of existing water rights or acquisition of new water rights by Zone 7. Water could be conveyed to the Zone 7 distribution system via a new intertie connecting the southern part of EBMUD's San Ramon Valley system with Zone 7 transmission facilities. This study assumed an intertie size of up to 25 MGD, with a potential annual transfer of up to 15,000 acre-feet in average or wet hydrologic years.

Potential beneficiaries, supply quantities, and conceptual facilities for the Bay Area Use of the Freeport Regional Water Project concept are summarized in Table 3-13 and Figure 3-12.

Table 3-13. Bay Area Use of the Freeport Regional Water Project Potential Partner and Supply Amounts

Type of Benefit	*Potential Amount (AFY)*	*Notes/Issues*
EBMUD		
Owning Agency		
Zone 7		
Dry Year Supply Reliability(1)	0 AFY	Deliveries via new 25 MGD connection between EBMUD and Zone 7, for direct delivery for blending, or for storage in groundwater basin for subsequent extraction.
Average Year Water Quality	Up to 15,000 AFY	

(1) If water is injected into groundwater basin for subsequent extraction, this could provide a dry year supply reliability benefit to Zone 7. However, Zone 7 has indicated that they are not currently seeking dry year supply. As such, this concept has been evaluated as a water quality concept only.

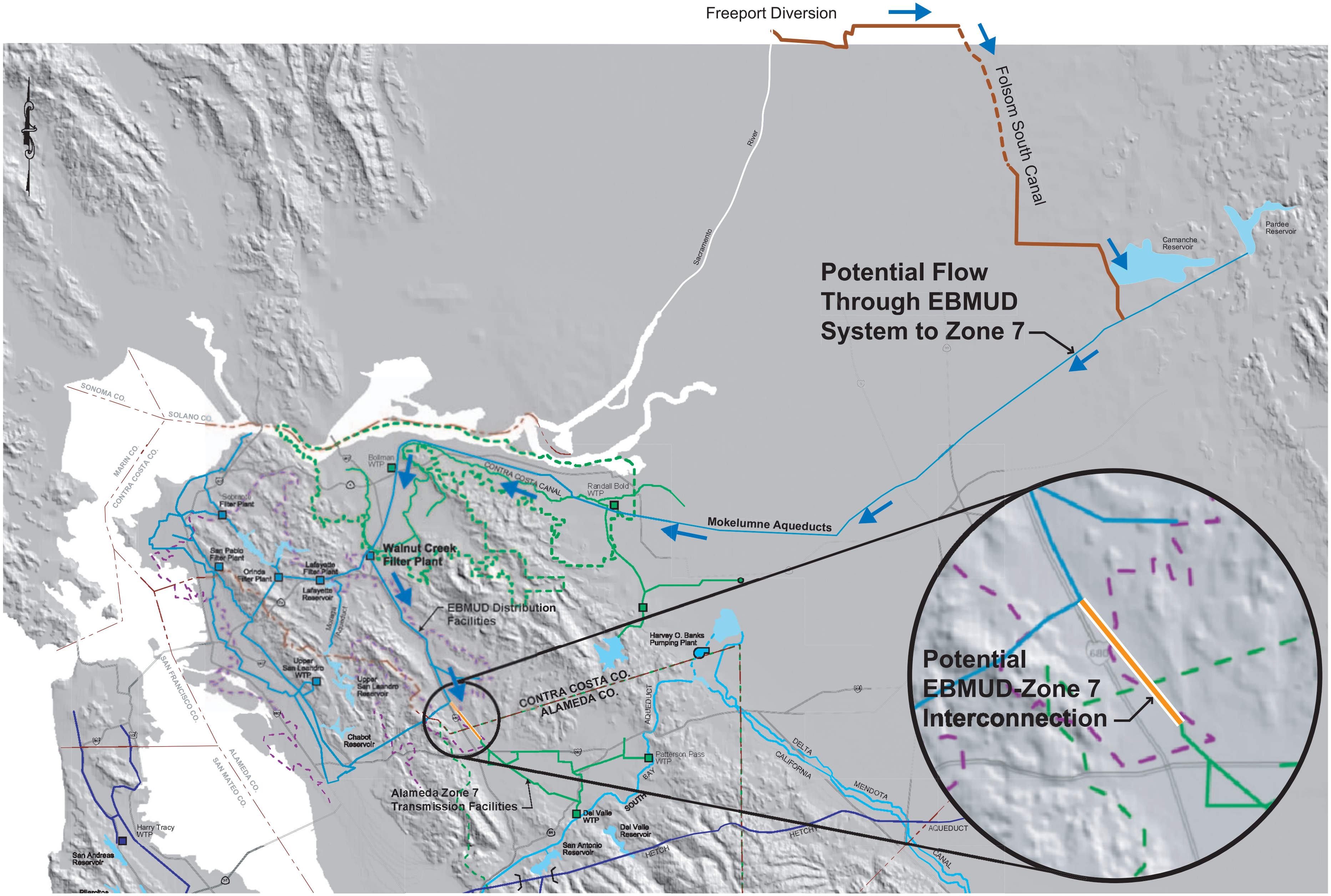

Figure 3-12

Bay Area Regional Use of the Freeport Regional Water Project Concept Facilities

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3.3 DEVELOPMENT OF EXAMPLE PORTFOLIOS

Once project concepts were identified, and sufficient detail was developed to evaluate the benefits and impacts of these concepts to the participating agencies, concepts were grouped into examples of synergistic combinations, termed “example portfolios,” with the goal of maximizing potential benefits through regional cooperation.

Even with a moderate number of concepts, there can be an unmanageable number of different combinations that form example portfolios. Therefore, a logical approach is needed to develop example portfolios. The main goal was to keep the initial set of example portfolios to about five or six. Another important goal of the example portfolio development was to achieve portfolios that were distinct from one another. This is important to illustrate trade-offs and will aid agency representatives in selecting preferred strategies at the completion of this project.

There are two general approaches that can be used to develop portfolios. One is called a “thematic” approach. Themes may be based on policy preferences, technology choices, or other definitions. An example of two different themes might be: “Traditional Solutions” vs. “Demand-side Management.” The “Traditional Solutions” portfolio would include structural solutions such as new reservoirs and treatment, whereas the “Demand-side Management” portfolio would include concepts such conservation and recycling. Themes could also be used to define different approaches to meeting a specific objective. For example, if the objective were to improve supply reliability, there could be several themes to accomplish this (e.g., a reservoir emphasis, a desalination emphasis, or combination).

The other approach to building the example portfolios is the “incremental” approach. Under this approach, key objectives are typically used to define each portfolio. Each concept is then rated as to its ability to meet these key objectives (from very low to very high). For the given objective (and portfolio), the concepts are then evaluated, sorted, and “incrementally” added to that portfolio until the objective is satisfied. Given the various different value systems and decision-making processes employed by the participating agencies, factors such as the importance and value of various “key objectives,” and the degree to which each concept is perceived to achieve these objectives, are likely to differ between these participating agencies. The incremental approach to portfolio building would therefore require that all concepts be defined to an equally high degree. The concepts retained for detailed evaluation in this Program have been refined to varying degrees. Some concepts, such as the Los Vaqueros Reservoir Expansion, are well-defined, while others, including the Regional Desalination Project, are less well developed, and have limited data available.

Both approaches have merit, and in fact, can be used together. Due to the variety in level of concept development, the Program first used the thematic approach to portfolio building to develop example portfolios based on themes. The incremental approach was then taken to further refine the example portfolios and facilitate agency evaluation.

3.3.1 Example Portfolio Themes

The Program is based on two primary goals: improvement of water quality and water supply reliability for the participating agencies. The example portfolio themes were therefore framed around the two fundamental tenets of the Program: Maximize Water Quality and Maximize Water Supply Reliability. Figure 3-13 depicts the general process for example portfolio development.

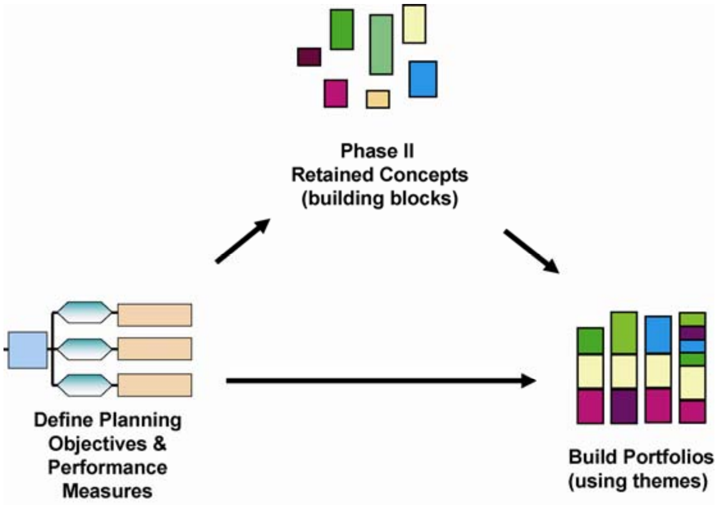

Figure 3-13
Example Portfolio Development

3.3.1.1 Theme I: Maximize Water Quality

Phase 1 of the Program revealed that blending of Sierra and Delta supplies alone would be insufficient to achieve the Delta source water quality targets set forth in the CALFED ROD. The fundamental limitation to blending for water quality improvements was supply quantity; it was found that there is not enough Sierra supply to dilute the parameters of concern in Delta supplies. A portfolio constructed to achieve the Maximize Water Quality theme would need to contain the maximum available supply of high quality water to achieve the maximum possible Delta water quality benefit. As a result, only one example portfolio was constructed for this theme. The Maximize Water Quality portfolio contains all the Phase 2 concepts identified as providing water quality benefits to participants[3]: Calaveras Reservoir Expansion (water quality operation), Los Vaqueros Reservoir Expansion, and Mirant Desalination with Water Quality Element.

3.3.1.2 Theme II: Maximize Water Supply Reliability

All participating agencies, with the exception of Zone 7, are interested in exploring additional sources of dry year supply. The majority of the concepts retained in Phase 2 of the Program contain water supply reliability elements. However, it is unlikely that all concepts retained for detailed evaluation will proceed to implementation, due to factors such as competing budgetary considerations, overlapping distribution system capacity requirements, limitations on non-potable demand, and environmental concerns.

In addition, consideration must be given to the types of projects selected for inclusion in an example portfolio, and the impacts that this will necessarily have on the attractiveness of that example portfolio to different stakeholder groups. The importance and degree of benefits and impacts perceived to be associated with concepts will vary for different stakeholders, depending upon the stakeholders' value systems. The benefits and impacts of storage projects may be perceived differently for some groups than for others. Similarly, the benefits and impacts of reclamation concepts are likely to be interpreted differently by different groups.

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[3] The Near Bay Bridge with Water Quality Element, Mirant Desalination with Water Quality Element, and Bay Area Use of the Freeport Regional Water Project all provide average year water quality benefits to Zone 7. However, all three concepts require the same intertie between EBMUD and Zone 7 and could not all go forward simultaneously. The Mirant Desalination with Water Quality Element concept was selected for inclusion in the Maximize Water Quality portfolio. This concept could be replaced with either the Bay Area Use of the Freeport Regional Water Project or Near Bay Bridge with Water Quality Element concepts to obtain similar average year water quality benefits for Zone 7.

In order to develop a wide spectrum of example portfolios catering to the wide variety of value systems of the stakeholders involved in the Program, and ultimately facilitate decision-making between alternatives, the fundamental theme of Maximize Water Supply Reliability was further split into two subthemes, based on the types of projects incorporated. The two subthemes are: Maximize Water Supply Reliability with Storage and Maximize Water Supply Reliability without Storage. The Maximize Water Supply Reliability with Storage subtheme is an analog to the Maximize Water Quality portfolio in that it includes all concepts identified in the Program as providing a water supply reliability benefit. The Maximize Water Supply Reliability without Storage theme includes all water supply reliability concepts identified in the Program, with the exception of the large reservoir expansion concepts.

The Program recognizes the potentially prohibitive capital cost investments and potential for diminishing returns associated with implementing multiple large reservoir expansion concepts. A major area of decision making for participating agencies will likely be determining which, if either, reservoir expansion project is most favorable for each agency. To further facilitate the decision-making process, the Maximize Water Supply Reliability with Storage subtheme was evaluated for each of the large reservoir expansion projects: Maximize Water Supply Reliability including Los Vaqueros Reservoir Expansion, and Maximize Water Supply Reliability including Calaveras Reservoir Expansion.

The resulting five example portfolio themes and their included concepts are presented in Table 3-14, below. Each example portfolio will benefit all participating agencies in some way or another.

TABLE 3-14. Example Portfolio Themes and Concepts Included

Concepts Included	Example Portfolios				
	Maximize Water Quality(1)	*Maximize Water Supply Reliability with Storage*	*Maximize Water Supply Reliability with Los Vaqueros Reservoir Expansion*	*Maximize Water Supply Reliability with Calaveras Reservoir Expansion*	*Maximize Water Supply Reliability Without Storage*
Los Vaqueros Reservoir Expansion	✓	✓	✓		
Calaveras Reservoir Expansion (operate to maximize yield)		✓		✓	
Calaveras Reservoir Expansion (operate to maximize quality)	✓				
Regional Desalination Project		✓	✓	✓	✓
Mirant Desal with Water Quality Element	✓				
Near Bay Bridge Desal with Water Quality Element					
South Bay Desal		✓	✓	✓	✓
East Bay Saline Groundwater Desal		✓	✓	✓	✓
Bay Area Use of the Freeport Regional Water Project					
Enhanced Conservation(2)		✓	✓	✓	✓
Water Recycling Concepts		✓	✓	✓	✓

(1) The Near Bay Bridge with Water Quality Element, Mirant Desalination with Water Quality Element, and Bay Area Use of the Freeport Regional Water Project all provide average year water quality benefits to Zone 7. However, all three concepts require the same available capacity in the Zone 7 system and could not all go forward simultaneously. The Mirant Desalination with Water Quality Element concept was selected for inclusion in the Maximize Water Quality portfolio. This concept could be replaced with either the Bay Area Use of the Freeport Regional Water Project or Near Bay Bridge with Water Quality Element concepts to obtain similar average year water quality benefits for Zone 7.

(2) Enhanced Conservation includes conservation above and beyond the 180,000 AFY of current and planned conservation.

Section 4

Evaluation of Concepts and Example Portfolios

Section 4
Evaluation of Concepts and Example Portfolios

Section 3 described the process of developing the concepts and example portfolios to be evaluated in Phase 2 of the program. The intent of the example portfolios is to illustrate potential synergistic combinations of concepts. A wide array of potential concept combinations exists, and only an illustrative subset was selected for inclusion in the Program analysis. To provide complete information on each of the alternatives and example portfolios retained by BAWQ&SRP, detailed analysis of both the individual concepts and example portfolios was conducted.

The following sections describe the process for evaluating the concept and example portfolios with respect to the baseline information, including parameters considered, modeling and additional analysis performed, and development of concept and example portfolio scorecards. Additionally, summary results from the water quality analysis are presented for each concept and example portfolio.

4.1 ANALYTICAL METHODS

To determine the potential benefits or impacts to agencies resulting from implementation of a concept or portfolio, the interactions between existing and future water supplies must be evaluated from both a supply and a water quality standpoint. Quantitative monthly supply amounts were developed for each agency. In addition, water quality impacts were analyzed by modeling the concentrations of key source and treated water quality parameters agreed upon by the Technical Team. The key source water parameters included bromide, TOC, and TDS, and were selected due to their strong impact on DBP production, taste and odor issues, and treatment requirements. In addition, the CALFED ROD sets forth goals of 3.0 mg/L for source water TOC and 50 µg/L for source water bromide, further identifying those parameters as key source water quality constituents and establishing external benchmarks for evaluating the benefits or impacts associated with concept or example portfolio implementation. Quantitative estimates of DBP production, including haloacetic acids (HAA5), trihalomethanes (THM4), and bromate were developed to determine potential regulatory impacts associated with concept or portfolio implementation. A qualitative analysis was also performed to evaluate the potential effect of concept and example portfolio implementation on agency source water temperature and pH.

Two levels of modeling were performed. Modeling software and Excel spreadsheets were used to develop system analysis representing the interactions between the individual participating agencies' water systems. These models were used to estimate monthly supply quantities and source water TDS, TOC, and bromide concentrations for each agency and concept or portfolio. The U.S. Environmental Protection Agency's (USEPA's) WTP model version 2 was used to simulate water treatment for each agency, producing monthly estimates of HAA5, THM4 and bromate concentrations for each agency with concept or example portfolio implementation. Water quality parameters modeled, targets, and the basis for modeling are summarized in Table 4-1. The modeling approaches are described in further detail below.

TABLE 4-1. Parameters, Targets, and Models for Evaluation

Parameter	Target	Source of Target	Model	Basis for Calculation
Source Water Parameters				
TDS	N/A	Industrial, Recycling and Taste Impacts	Analysis tools	Mass Balance, assumed to be conservative
TOC	3.0 mg/L	CALFED ROD	Analysis tools	Mass Balance, assumed to be conservative
Bromide	50 µg/L	CALFED ROD	Analysis tools	Mass Balance, assumed to be conservative
Treated Water Parameters				
TDS	N/A	Industrial, Recycling and Taste Impacts	N/A	Mass Balance, assumed to be conservative
THM_4	80 µg/L	Stage 2 of the Disinfectants and Disinfection By-Products (D/DBP2) Rule	WTP	Empirical correlations to predict central tendencies for natural organic matter (NOM) removal, disinfection, and DBP formation for specified treatment processes. NOM characteristics, TOC and ultraviolet absorbance at 254 nm (UVA), bromide concentration, temperature, pH, disinfectant dose and reaction times
HAA_5	60 µg/L	D/DBP2 Rule	WTP	Empirical correlations to predict central tendencies for NOM removal, disinfection, and DBP formation for specified treatment processes. NOM characteristics, TOC and UVA, bromide concentration, temperature, pH, disinfectant dose and reaction times
Bromate	10 µg/L	D/DBP2 Rule	WTP	Bromate model of Ozekin and Amy.(1) Based on ozone dose, bromide, DOC, and pH. Equation used: $BrO_3 = 1.63x10^{-6}\ DOC^{-1.26}\ pH^{5.82}\ (O_3\ dose)^{1.57}\ Bromide^{0.73}\ time^{0.28}$ was developed based on Delta source water diversions, with source bromide and bromate levels ranging from 70 to 440 µg/L, and 2 to 314 µg/L, respectively.

(1) Amy, G.L., M. Siddiqui, K. Ozekin, H.W. Zhu, and C. Wang, (1998). Empirically Based Models for Predicting Chlorination and Ozonation By-Product: Haloacetic Acids, Chloral Hydrate, and Bromate. EPA Report CX 819579. USEPA Office of Groundwater and Drinking Water: Cincinnati, OH, 1998.

4.1.1 Source Water Supply and Water Quality Modeling

The Program evaluated water supply and water quality with respect to imported supplies for each participating agency. The effects of local supplies, including local runoff and groundwater, were neglected for simplicity. As such, the concepts and example portfolios were evaluated using analysis tools including simple models and spreadsheets to identify their effects on imported supplies prior to treatment. The source water quality of each agency's imported supplies, including TDS, TOC, and bromide levels, was generated by using these tools.

The analysis tools were created to simulate the participating agencies' water supply systems. Three primary imported supply sources were modeled: Tuolumne River, Mokelumne River, and Delta supplies. Due to the large degree of variability in water quality for different Delta diversions, this supply was further split into three sources: Rock Slough, Old River/Middle River, and Harvey O. Banks Pumping Plant. Seven reservoirs were included in the model: San Antonio Reservoir, Calaveras Reservoir, SFPUC Peninsula

Reservoirs (Crystal Springs, Pilarcitos and San Andreas Reservoirs modeled as one system), Los Vaqueros Reservoir, and Del Valle Reservoir. Conveyance systems including the Hetch Hetchy Aqueducts, Mokelumne Aqueduct, South Bay Aqueduct, Central Valley Project and existing agency interconnections were also developed. Recycled water and conservation were assumed to reduce demand, and were not modeled as additional supplies. The model also included each concept for which quantitative supply and water quality data was developed (Calaveras Reservoir Expansion, Los Vaqueros Reservoir Expansion, Mirant Desalination with Water Quality Element, Near Bay Bridge Desalination with Water Quality Element, South Bay Desalination, East Bay Saline Groundwater Desalination, Bay Area Use of the Freeport Regional Water Project), so the effects of implementing one or more concepts could be evaluated.

Historical and simulated year 2020 baseline monthly water quality and water supply data was compiled for each supply to evaluate average year, extended drought and critically dry year supply and water quality conditions. This data was used in the model to develop baseline supply and water quality conditions for imported supplies on a monthly time-step for representative hydrologic periods. Once baseline conditions were assessed, the model was used to evaluate system operation with potential concepts, estimating changes in source supply and water quality conditions for different hydrologic year types.

In addition to comparing to baseline water quality for each agency, the water quality output may be compared to the source water quality targets established by the CALFED ROD. The ROD sets forth goals of 3.0 mg/L for source water TOC and 50 µg/L for source water bromide, or achievement of an equivalent level of public health protection. These target concentrations serve as external benchmarks for evaluating the benefits or impacts associated with concept or example portfolio implementation.

4.1.2 Treated Water Quality

While the analysis tools can be used to develop source water supply projections and source water quality estimates that are useful for comparison with the CALFED ROD source water quality targets[1], many of the existing water quality regulations center instead on treated water quality. Specifically, many of the current and future drinking water regulations focus on chemical byproducts introduced in the process of disinfecting supplies at water treatment plants, or disinfection byproducts. USEPA's WTP model version 2 was used to model the effects of concept and example portfolio implementation on DBP generation.

USEPA WTP model was used to model THM4, HAA5, and bromate concentrations of treated water, as described in Table 4-1. In addition, treated water TDS was estimated for each agency based on the respective treatment processes of each agency.

These parameters were compared with baseline values, calculated based on existing and planned treatment, to determine the benefit or impact of concept or example portfolio implementation on treated water quality. In addition to comparing to baseline treated water quality for each agency, the water quality output was compared to the treated water quality regulations and targets established by regulations including Stage 2 of the Disinfectants and Disinfection Byproducts rule. Targets of 80 µg/L for THM4 and 60 µg/L for HAA5, based on quarterly running annual averages (RAAs), and 10 µg/L for treated water bromate, based on monthly RAAs, serve as treated water analogs to the CALFED ROD source water quality targets. That is, they may be used as external benchmarks for evaluating the benefits or impacts associated with concept or example portfolio implementation.

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[1] CALFED ROD water quality targets included 50 µg/L source water bromide and 3.0 mg/L source water TOC.

Parameters used to model each agency's water treatment plants are included in Appendix D. This information was developed based on the treatment processes described in Section 2.2.3 of this report.

4.1.3 Environmental Analysis

Programmatic-level analyses were conducted for example portfolios and individual concepts; these are typically completed where site-specific details, such as facility locations, construction scenarios, and operational strategies have not yet been determined. Program-level analyses focus on potential effects that are expected to occur given the type of project and the general locations of project facilities. For example, it could be assumed that facility siting and construction could adversely affect wetland resources in areas where such resources occur. Absent site-specific project location or a commitment that facilities would be designed to avoid wetland resources, at this early stage of evaluation, potential effects could occur. As site-specific information is not available for most of the concepts, potential effects are qualitatively characterized based on an understanding of similar projects and assumptions regarding facility locations. An exception to the program-level evaluation is the Los Vaqueros Expansion Projects, for which studies have been conducted. For this concept, information previously developed as part of the *Los Vaqueros Reservoir Expansion Studies* (CALFED, 2004) was summarized in the characterization of environmental effects.

For all issue areas, mitigation opportunities were identified where feasible such that potential adverse effects could be avoided or reduced. The need for such mitigation would ultimately depend on final location of the facilities and actual impacts caused from concept implementation. However, mitigation opportunities are included in this analysis to allow for comparison of potential effects or benefits before and after mitigation.

All relevant environmental issues would need further investigation and clarification at a project-level of detail prior to implementation by participating agencies if any of the portfolios and/or concepts is pursued. This level of detail would allow for a more thorough characterization of environmental effects and development of mitigation strategies that address actual adverse impacts.

4.2 CONCEPT AND PORTFOLIO SCORECARDS

Using the analysis tools, supply quantities and qualities were projected for each agency with and without each concept and example portfolio. While this data provides information regarding the water supply and water quality benefits and/or impacts associated with potential implementation of concepts and example portfolios, a suite of additional information is required to assist agencies in deciding whether the concepts and example portfolios merit additional study. As described in Section 1.5 of this document, a set of Objectives and Performance Measures were developed to represent the goals of the BAWAC agencies. These Objectives and Performance Measures were intended to serve as criteria for evaluating the performance of concepts and portfolios.

As part of the Program, each concept and example portfolio was evaluated with respect to each objective and performance measure identified. Concepts were evaluated individually to determine the potential benefit or impact of each concept for each agency. Example portfolios were evaluated to determine the potential benefit or impact of the example portfolio, whether equal to or greater than the sum of the benefits and/or impacts of the individual concepts comprising the portfolio.

The results from those evaluations, as well as the water supply and water quality data developed through the modeling efforts, were compiled into comprehensive tables for each concept and example portfolio, termed "scorecards." The scorecards are intended to provide each agency with the information required to make determinations as to whether each concept and example portfolio alternative merits additional study and possible future implementation.

Each section of the scorecard presents an evaluation of the concept or example portfolio with respect to different objectives and performance measures. In some cases, the evaluations were qualitative assessments of concept or example portfolio performance in achieving the objectives, and in other cases, assessments were quantitative in nature. A series of technical team workshops were held in which agency representatives were presented with various alternatives for organizing and characterizing the information developed through the evaluation process. For each qualitative assessment included in the scorecards, descriptive metrics were developed for rating each concept and example portfolio. Further, it was decided that each qualitative rating should be accompanied by detailed narrative description of why the selected rating was assigned.

The following sections describe the various scorecard elements, as well as the qualitative metrics used to rate each concept and example portfolio. Scorecards for concepts and example portfolios are included in Appendix G of this document.

4.2.1 Scorecard Elements

The scorecards are intended to present evaluations of each concept and example portfolios with respect to the objectives and performance measures developed by BAWAC. The objectives were grouped into tables that cover the five primary objectives developed by BAWAC of Supply Reliability, Public Health Protection, Cost Impacts, Environmental Impacts, and Implementation Potential. An additional table was also added to address the more detailed environmental sub-objectives.

Each concept and example portfolio scorecard consists of the same basic elements: a concept summary description followed by concept performance data and ratings for each of the objectives and performance measures. The performance data and ratings are organized into the following tables, which are consistent for all concept and example portfolio scorecards:

- Table 1 – Supply Reliability Scorecard
- Table 2 – Public Health Protection Scorecard
- Table 2a, 2b, 2c, etc. – Health Protection Scorecard (by agency)
- Table 3 – Cost, Environmental, and Implementation Scorecards
- Table 4 – Environmental Scorecard

Each of these tables is described in further detail below.

In cases where quantitative water quality data was available, the scorecards also contain graphs of water quality baseline and concept, or example portfolio results. Scorecards contain combinations of quantitative data and qualitative assessments in the form of ratings and narrative descriptions. Ratings are specific to each sub-objective, and do not address the degree to which concepts and example portfolios conform to or diverge from objectives and performance measures or other concepts and portfolios. It will be left to the participating agencies to assess the subtleties of what constitutes a significant result.

Each concept and example portfolio was evaluated to determine the degree to which it achieved each subobjective. Some concepts provide a supply source that is untreated, and is mixed with the agency's source water prior to treatment. In these cases, the combination of the concept and the agency's baseline source water was evaluated both before and after treatment with respect to the baseline supply. Other concepts provide a treated supply source that is intended to be injected into the distribution system, affecting the supply and water quality of only a portion of the agency's distribution system. These concepts were evaluated as the treated water from the concept (without distribution system blending) compared to the agency baseline treated supply.

Scorecards for each retained concept and example portfolio can be found in Appendix G of this document.

4.2.1.1 Table 1 – Supply Reliability Scorecard

The first table included in the scorecard, Supply Reliability, addresses the sub-objectives and performance measures related to supply reliability. The sub-objectives evaluated in this table are: Meet Demand, Vulnerability, and Self-sufficiency Within the Region. Descriptions of each sub-objective, as well as the metrics for evaluating each sub-objective, are included in Table 4-2.

TABLE 4-2. Sub-objectives and Metrics used in Table 1 of the Scorecards

Sub-objective	*Description*	*Metric*	*Explanation*
Objective: Supply Reliability			
Meet Demand	Evaluates concept/example portfolio based on ability to meet demands. Contains the projected quantitative supplies to each agency under three scenarios: baseline supply (year 2020, no concept implementation), the concept supply (projected supply from the concept alone), and baseline plus concept (displays the degree to which the concept supply offsets or supplements the baseline).	Concept Supply	Concept supply to each agency under different hydrologic conditions compared to baseline.
Vulnerability	Evaluates concepts/example portfolios based on their ability to minimize agency vulnerability. Vulnerability is assessed as dependence on extensive conveyance potentially subject to catastrophes including earthquakes and terrorism, as well as vulnerability to hydrologic events such as droughts.	Reduces Vulnerability	The concept reduces vulnerability of agency to catastrophic events.
		No Effect on Vulnerability	The concept does not affect vulnerability of agency to catastrophic events.
		Increases Vulnerability	The concept increases vulnerability of agency to catastrophic events.
Self-Sufficiency Within the Region	Evaluates concepts/example portfolios based on their ability to maximize supply reliability by retaining control within the region. This refers to the ability of concepts to be controlled locally, limiting State and Federal control, and limiting involvement of external agencies and stakeholders.	Increases Regional Control	The concept increases regional control by reducing dependency on agencies outside the region.
		No Effect on Regional Control	The concept has no effect on regional control and does not change dependency on agencies outside the region.
		Decreases Regional Control	The concept reduces regional control by increasing dependency on agencies outside the region.

4.2.1.2 Table 2 – Public Health Protection Scorecard

The second table included in the scorecard, Public Health Protection, provides an overview of the concept or example portfolio's performance in protecting public health by providing the highest quality water possible.

Table 2 consists of multiple subparts. The primary table (titled "Table 2") provides an overview for all agencies, using a rating system to indicate whether water quality is improved or degraded by the concept or portfolio. The secondary tables (titled "Table 2a," "Table 2b") contain quantitative projected water quality data for each participating agency whose water quality would be affected by concept or example portfolio implementation, where available. The primary and secondary tables organize ratings and/or data into three columns[2]: baseline, concept, and baseline plus concept. The baseline column contains ratings or data reflecting projections for the agency's year 2020, no concept implementation condition. The concept column contains ratings or data for the concept itself where the concept water quality can be separated from the baseline. In some cases, such as the Los Vaqueros Reservoir Expansion, the concept does not yield a distinct supply that can be separated from the baseline. In these situations, this column will not be applicable. The baseline plus concept column contains ratings or data for the concept and baseline combined, and is intended to reflect the overall benefit or impact of implementation of the concept. In some situations, such as the Mirant with Water Quality Element concept, the supply will not be blended with the entire agency's supply, and projected blended water qualities are not available. In these cases, this column will not be applicable.

The sub-objectives evaluated in the primary and secondary tables are: Variability for Treatment, Total Dissolved Solids, Disinfection By-Products, Taste and Odor Problems (Excluding TDS), Potential for Water Quality Degradation from Known Contaminants, and Potential for Water Quality Degradation from Emerging Contaminants. The metrics for evaluating each Public Health sub-objective by table are included in Table 4-3.

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[2] N/A is used to indicate that the column does not apply to the given sub-objective.

TABLE 4-3. Sub-objectives and Metrics Used in Tables 2 and 2a of the Scorecards

Sub-objective	*Description*	*Metric*	*Explanation*
SCORECARD TABLE 2			
Objective: Public Health Protection			
Variability for Treatment	Evaluates concepts/example portfolios based on the variability of source water parameters of the concept or example portfolio, as well as for the baseline plus concept or example portfolio, where applicable. Variability is assessed based on the variability of target source water quality parameters, including TOC, TDS, bromide, temperature, and pH in source waters prior to treatment.	Reduces Variability	The concept produces a net reduction in the variability of source water TOC, bromide, temperature, pH compared to baseline.
		No Effect on Variability	The concept does not change the variability of source water TOC, bromide, temperature, pH compared to baseline.
		Increases Variability	The concept produces a net increase in the variability of source water TOC, bromide, temperature, pH compared to baseline.
TDS	Evaluate concepts/example portfolios based on the concentration of TDS of the concept or example portfolio, as well as for the baseline plus concept or example portfolio, for source and treated water, where applicable.	Reduces TDS	The concept produces a reduction in source water TDS compared to baseline.
		No Effect on TDS	The concept does not change source water TDS compared to baseline.
		Increases TDS	The concept produces an increase in source water TDS compared to baseline.
Disinfection By-Products	Evaluates concepts/example portfolios based on the concentration of DBPs of the concept or example portfolio, as well as for the baseline plus concept or example portfolio. This category only applies to treated water, as disinfection by-products are generated as a result of disinfection.	Reduces DBPs	The concept produces a reduction in treated water DBPs compared to baseline.
		No Effect on DBPs	The concept does not change treated water DBPs compared to baseline.
		Increases DBPs	The concept produces an increase in treated water DBPs compared to baseline.
Taste and Odor Problems (excluding TDS)	Evaluates concepts/example portfolios based on the likelihood of increased or decreased taste and odor of the concept or example portfolio, as well as for the baseline plus concept or example portfolio. Potential causes of taste and odor (T&O) impacts include algal blooms, elevated turbidity, and elevated salinity.	Improves T&O	The concept produces an improvement in treated water taste and odor compared to baseline.
		No Effect on T&O	The concept does not change treated water taste and odor compared to baseline.
		Degrades T&O	The concept degrades treated water taste and odor compared to baseline.
Minimize Potential for Water Quality Degradation from Known Impacts	Evaluates concepts/example portfolios based on the possibility that implementation of a concept may lead to water quality degradation from known contaminants. An example of potential for water quality degradation from known contaminants is the potential for increased TDS in groundwater supplies from implementation of recycled water concepts over sensitive groundwater basins.	Reduced Potential for Degradation	The concept reduces the potential for source water degradation from known impacts (e.g., TDS, etc).
		No Effect on Potential for Degradation	The concept does not affect the potential for source water degradation from known impacts (e.g., TDS, etc).
		Increases Potential for Degradation	The concept increases the potential for source water degradation from known impacts (e.g., TDS, etc).

TABLE 4-3. Sub-objectives and Metrics Used in Tables 2 and 2a of the Scorecards

Sub-objective	*Description*	*Metric*	*Explanation*
Potential for Water Quality Degradation from Emerging Contaminants	Evaluates concepts/example portfolios based on the possibility that implementation of a concept may lead to water quality degradation from known contaminants. An example of potential for water quality degradation from emerging contaminants is the potential for contamination of groundwater by N-nitrosodimethylamine (NDMA) or other emerging contaminants resulting from implementation of recycled water concepts over sensitive groundwater basins. Potential introduction of algal toxins via desalinated supplies would present an additional example of potential degradation from emerging contaminants.	Reduced Potential for Degradation	The concept reduces the potential for source water degradation from emerging contaminants (e.g., NDMA, algal toxins, etc).
		No Effect on Potential for Degradation	The concept does not affect the potential for source water degradation from emerging contaminants (e.g., NDMA, algal toxins, etc).
		Increases Potential for Degradation	The concept increases the potential for source water degradation from emerging contaminants (e.g., NDMA, algal toxins, etc).
SCORECARD TABLE 2a			
Objective: Public Health Protection			
Variability for Treatment	Evaluates concepts/example portfolios based on the variability of source water parameters of the concept or example portfolio, as well as for the baseline plus concept or example portfolio, where applicable. Variability is assessed based on the variability of target source water quality parameters, including TOC, TDS, bromide, temperature, and pH in source waters prior to treatment.	Bromide	Quantitative projected source water bromide minimum, maximum, and average concentrations presented for baseline, concept, and concept plus baseline, where applicable.
		TOC	Quantitative projected source water TOC minimum, maximum, and average concentrations presented for baseline, concept, and concept plus baseline, where applicable.
		pH	Qualitative discussion of pH variability presented for baseline, concept, and concept plus baseline, where applicable.
		Temperature	Qualitative discussion of temperature variability presented for baseline, concept, and concept plus baseline, where applicable.
TDS	Evaluate concepts/example portfolios based on the concentration of TDS of the concept or example portfolio, as well as for the baseline plus concept or example portfolio, for source and treated water, where applicable.	TDS	Quantitative projected source and treated water TDS minimum, maximum, and average concentrations presented for baseline, concept, and concept plus baseline, where applicable.
Disinfection By-Products	Evaluates concepts/example portfolios based on the concentration of DBPs of the concept or example portfolio, as well as for the baseline plus concept or example portfolio. This category only applies to treated water, as disinfection by-products are generated as a result of disinfection	Bromate	Quantitative projected treated water bromate minimum, maximum, and average concentrations presented for baseline, concept, and concept plus baseline, where applicable.
		THM4	Quantitative projected treated water THM4 minimum, maximum, and average concentrations presented for baseline, concept, and concept plus baseline, where applicable.
		HAA5	Quantitative projected treated water HAA5 minimum, maximum, and average concentrations presented for baseline, concept, and concept plus baseline, where applicable.

TABLE 4-3. Sub-objectives and Metrics Used in Tables 2 and 2a of the Scorecards

Sub-objective	Description	Metric	Explanation
Taste and Odor Problems (excluding TDS)	Evaluates concepts/example portfolios based on the likelihood of increased or decreased taste and odor of the concept or example portfolio, as well as for the baseline plus concept or example portfolio. Potential causes of taste and odor impacts include algal blooms, elevated turbidity, and elevated salinity.	Source of Water	Qualitative discussion of effect of the source of water on taste and odor presented for baseline, concept, and concept plus baseline, where applicable.
		Algal Blooms	Qualitative discussion of potential for algal blooms to affect taste and odor presented for baseline, concept, and concept plus baseline, where applicable.

4.2.1.3 Table 3 – Cost, Environmental, and Implementation Scorecards

The third table included in the scorecard, Cost, Environmental, and Implementation, addresses objectives and performance measures related to minimizing costs, minimizing environmental impacts, and maximizing implementation potential. The performance measures evaluated in this table are: Cost Impacts, Environmental Impacts, Implementation Potential, and Regional Perspectives. Descriptions of each sub-objective, as well as the metrics for evaluating each sub-objective, are included in Table 4-4.

TABLE 4-4. Sub-objectives and Metrics Used in Table 3 of the Scorecards

Sub-objective	*Description*	*Metric*	*Explanation*
SCORECARD TABLE 3			
Objective: Cost Impacts			
Total Cost	Contains projected capital cost, operating and maintenance cost, environmental mitigation costs, and lifecycle costs (assuming 30 years at 6 percent) for the concept or example portfolio. Narrative description of the basis for costs estimates is also provided. No ratings are given for performance in this category.	Capital Cost	Contains estimate and discussion of Capital Cost.
		Operating & Maintenance Cost	Contains estimate and discussion of Operating and Maintenance Costs.
		Environmental Mitigation Cost	Contains estimate and discussion of Environmental Mitigation Costs.
		Lifecycle Cost	Contains estimate and discussions of Lifecycle Costs.
		Allocation of Costs	Contains estimate and discussion of Allocation of Costs.
Objective: Environmental Impacts			
Overall Impacts to the Environment	Evaluates concepts/example portfolios based on their potential, overall impacts to the environment as assessed both prior to and following mitigation. This objective includes consideration of effects to aquatic, terrestrial, and wetlands resources, and special status species, as well as increases in energy consumption and pollutant emissions.	No Impact to Environment (Before Mitigation)	The concept produces no impact to the environment before mitigation.
		Low Overall Impact to Environment (Before Mitigation)	The concept produces a low overall impact to the environment before mitigation.
		High Overall Impact to Environment (Before Mitigation)	The concept produces a high overall impact to the environment before mitigation.
		No Impact to Environment (After Mitigation)	The concept produces no impact to the environment after mitigation.
		Low Overall Impact to Environment (After Mitigation)	The concept produces a low overall impact to the environment after mitigation.
		High Overall Impact to Environment (After Mitigation)	The concept produces a high overall impact to the environment after mitigation.
Overall Benefits to the Environment	Evaluates concepts/example portfolios based on their potential, overall benefits to the environment as assessed both prior to and following mitigation. This objective includes consideration of effects to aquatic, terrestrial, and wetlands resources, and special status species, as well as increases in energy consumption and pollutant emissions.	High Overall Benefits to Environment (Before Mitigation)	The concept produces many overall benefits to the environment before mitigation.
		Low Overall Benefits to Environment (Before Mitigation)	The concept produces few overall benefits to the environment before mitigation.
		No Benefits to Environment (Before Mitigation)	The concept produces no overall benefits to the environment before mitigation.
		High Overall Benefits to Environment (After Mitigation)	The concept produces many overall benefits to the environment after mitigation.
		Low Overall Benefits to Environment (After Mitigation)	The concept produces few overall benefits to the environment after mitigation.
		No Benefits to Environment (After Mitigation)	The concept produces no overall benefits to the environment after mitigation.

TABLE 4-4. Sub-objectives and Metrics Used in Table 3 of the Scorecards

Sub-objective	Description	Metric	Explanation
Objective: Implementation Potential			
External Support	Evaluates concepts/ example portfolios based on the support they are likely to receive from external agencies and stakeholder.	High Degree of External Support	The concept is likely to achieve a large amount of support from external sources.
		No External Support	The concept is not likely to achieve any support from external sources.
		External Opposition	The concept is likely to be opposed by many external sources.
Ability to Get Outside Funding	Evaluates concepts/ example portfolios based on the likelihood that they will qualify for and be considered for outside funding.	Likely to Gain External Funding	The concept is likely to qualify for and receive external funding.
		Unlikely to Gain External Funding	The concept is unlikely to qualify for and receive external funding.
Internal Consistency with Local and Regional Plans	Evaluates concepts/ example portfolios based on the degree to which they conform with goals and objectives of local and regional initiatives and plans.	Consistent with Local and Regional Plans	The concept is consistent with goals and values expressed in local and regional plans.
		Inconsistent with Local and Regional Plans	The concept is at odds with goals and values expressed in local and regional plans.
Regional Perspective	Evaluates concept/example portfolio based on the total regional benefit, including the number of participating agencies and total population receiving benefits from concept or example portfolio implementation.	Number of Agencies Receiving Benefits	Contains the number of participating agencies projected to benefit from concept or example portfolio implementation.
		Population Receiving Benefits	Contains the total population projected to benefit from concept or example portfolio implementation.

4.2.1.4 Table 4 – Environmental Scorecard

The fourth table included in the scorecard, Environmental, addresses in part the environmental sub-objectives provided by the environmental caucus. Five environmental topics are evaluated, including aquatic resources, terrestrial resources, wetlands, special-status species, and energy consumption/pollutant emissions. These five topics are used in the evaluation of overall environmental impacts and benefits. They are intended to identify major issue areas that are important for most projects due to their importance from a regulatory standpoint and thus are benchmarks in defining project environmental effects (e.g., disturbance to wetlands is considered an adverse impact because wetlands are protected under the Clean Water Act), and because the topics would most likely aid in distinguishing among the example portfolios and concepts at a program level of detail. The sub-objectives are not exhaustive of the environmental issue areas that would require future examination. Other issue areas were also identified and qualitatively evaluated for each concept (see Appendix E).

The performance measures presented in this table are: Potential Impacts to Aquatic Environment, Potential Impacts to Terrestrial Environment (acreage affected), Potential Impacts to Wetlands (acreage affected), Potential Impacts to Special-Status Species (number of species), and Potential for Increase in Energy Consumption/Pollutant Emissions (amount of energy required for operation and criteria pollutants emitted). Descriptions of each sub-objective, as well as the metrics for evaluating each sub-objective, are included in Table 4-57.

TABLE 4-5. Sub-objectives and Metrics Used in Table 4 of the Scorecards

Sub-objective	*Description*	*Metric*	*Explanation*
Objective: Environmental Impacts			
Potential Impacts to Aquatic Environment	Evaluates concepts and example portfolios based on their potential benefits or impacts to the aquatic environment as assessed both prior to and following mitigation.	Benefits Aquatic Environment (Before Mitigation)	The concept benefits the aquatic environment before mitigation.
		No Effect on Aquatic Environment (Before Mitigation)	The concept does not affect the aquatic environment before mitigation.
		Impacts Aquatic Environment (Before Mitigation)	The concept impacts the aquatic environment before mitigation.
		Benefits Aquatic Environment (After Mitigation)	The concept benefits the aquatic environment after mitigation.
		No Effect on Aquatic Environment (After Mitigation)	The concept does not affect the aquatic environment after mitigation.
		Impacts Aquatic Environment (After Mitigation)	The concept impacts the aquatic environment after mitigation.
Potential Impacts to Terrestrial Environment (acreage affected)	Evaluates concepts and example portfolios based on their potential benefits or impacts to the terrestrial environment as assessed both prior to and following mitigation.	Benefits Terrestrial Environment (Before Mitigation)	The concept benefits the terrestrial environment before mitigation.
		No Effect on Terrestrial Environment (Before Mitigation)	The concept does not affect the terrestrial environment before mitigation.
		Impacts Terrestrial Environment (Before Mitigation)	The concept impacts the terrestrial environment before mitigation.
		Benefits Terrestrial Environment (After Mitigation)	The concept benefits the terrestrial environment after mitigation.
		No Effect on Terrestrial Environment (After Mitigation)	The concept does not affect the terrestrial environment after mitigation.
		Impacts Terrestrial Environment (After Mitigation)	The concept impacts the terrestrial environment after mitigation.

TABLE 4-5. Sub-objectives and Metrics Used in Table 4 of the Scorecards

Sub-objective	Description	Metric	Explanation
Potential Impacts to Wetland Resources (acreage affected)	Evaluates concepts and example portfolios based on their potential benefits or impacts to wetland resources as assessed both prior to and following mitigation.	Benefits Wetlands (Before Mitigation)	The concept benefits wetlands before mitigation.
		No Effect on Wetlands (Before Mitigation)	The concept does not affect wetlands before mitigation.
		Impacts Wetlands (Before Mitigation)	The concept impacts wetlands before mitigation.
		Benefits Wetlands (After Mitigation)	The concept benefits wetlands after mitigation.
		No Effect on Wetlands (After Mitigation)	The concept does not affect wetlands after mitigation.
		Impacts Wetlands (After Mitigation)	The concept impacts wetlands after mitigation.
Potential Impacts to Special-Status Species (number of species)	Evaluates concepts and example portfolios based on their potential benefits or impacts to special-status species as assessed both prior to and following mitigation.	Benefits Special-Status Species (Before Mitigation)	The concept benefits special-status species before mitigation.
		No Effect on Special-Status Species (Before Mitigation)	The concept does not affect special-status species before mitigation.
		Impacts Special-Status Species (Before Mitigation)	The concept impacts special-status species before mitigation.
		Benefits Special-Status Species (After Mitigation)	The concept benefits special-status species after mitigation.
		No Effect on Special-Status Species (After Mitigation)	The concept does not affect special-status species after mitigation.
		Impacts Special-Status Species (After Mitigation)	The concept impacts special-status species after mitigation.
Potential Increase in Energy Consumption (amount of energy required for operation)	Evaluates concepts and example portfolios based on their energy consumption both prior to and following mitigation.	Reduces Energy Consumption (Before Mitigation)	The concept does not consume energy and reduces energy consumption, energy before mitigation.
		No Effect on Energy Consumption (Before Mitigation)	The concept does not consume energy or affect energy consumption before mitigation.
		Increases Energy Consumption (Before Mitigation)	The concept consumes energy or increases energy consumption before mitigation.
		Reduces Energy Consumption (After Mitigation)	The concept does not consume energy and reduces energy consumption after mitigation.
		No Effect on Energy Consumption (After Mitigation)	The concept does not consume energy or affect energy consumption after mitigation.
		Increases Energy Consumption (After Mitigation)	The concept consumes energy or increases energy consumption after mitigation.

TABLE 4-5. Sub-objectives and Metrics Used in Table 4 of the Scorecards

Sub-objective	Description	Metric	Explanation
Potential Increase in Criteria Pollutant (Nox, Sox, ROG and CO) Production	Evaluates concepts/example portfolios based on their production of criteria pollutants both prior to and following mitigation.	Reduces Criteria Pollutants (Before Mitigation)	The concept does not produce, and reduces production of, criteria pollutants before mitigation.
		No Effect on Criteria Pollutants (Before Mitigation)	The concept does not produce, or affect production of, criteria pollutants before mitigation.
		Increases Criteria Pollutants (Before Mitigation)	The concept produces, or increases production of, criteria pollutants before mitigation.
		Reduces Criteria Pollutants (After Mitigation)	The concept does not produce, and reduces production of, criteria pollutants after mitigation.
		No Effect on Criteria Pollutants (After Mitigation)	The concept does not produce, or affect production of, criteria pollutants after mitigation.
		Increases Criteria Pollutants (After Mitigation)	The concept produces, or increases production of, criteria pollutants after mitigation.

4.3 SUMMARY OF FINDINGS

Section 3 presents the development of the Phase 2 concepts and example portfolios, and Appendix G "Concept, Example Portfolio, and Agency Scorecards" presents a preliminary assessment of how the individual concepts, and concepts combined to form portfolios, perform against the Program objectives and performance measures. Appendix G also includes the scorecards by agency for all concepts, and by agency for each portfolio.

It is not the purpose of this Program to provide a comparison between the concepts and example portfolios, or develop the relative weighting between the objectives and sub-objectives. This section presents some of the general findings for the concepts and example portfolios.

4.3.1 Concepts

Table 4-6 indicates the general information for the concepts, including the estimated dry year and average year water quality quantities, and potential partners.

TABLE 4-6. Summary of Concepts, Dry Year and Average Year Water Quality Supply, and Potential Partners

Concepts	Dry-Year Supply (AFY)	Avg. Year WQ (AFY)	Potential Partners(1)
Surface Water Storage			
Calaveras Reservoir Expansion (supply reliability operation)	Up to 53,000	0	SFPUC(1), SCVWD, BAWSCA, ACWD
Calaveras Reservoir Expansion (water quality and supply reliability operation)	Up to 41,000	Up to 50,000	SFPUC(1) (2), SCVWD, BAWSCA, ACWD
Los Vaqueros Reservoir Expansion	42,000	121,000	CCWD, Zone 7, SCVWD, ACWD, SFPUC(1)
Enhanced Conservation	not defined	0	All
Recycled Water Concepts	Up to 97,000	0	All
Desalination			
South Bay Desal Concepts (Up to 3)	Up to 13,800	Up to 8,300	SCVWD, SFPUC(1), BAWSCA
Regional Desal Project (RDP)	To be determined in future studies	To be determined in future studies	CCWD, EBMUD, SFPUC(1), SCVWD
Mirant Desal with Water Quality Element	To be determined in future studies	Up to 15,000	RDP Partners + Zone 7
Near Bay Bridge with Water Quality Element	To be determined in future studies	Up to 10,000	RDP Partners + Zone 7
East Bay Saline Groundwater Desal	Up to 16,000	Up to 16,000	SFPUC(1), BAWSCA, ACWD, SCVWD
Conveyance			
Bay Area Use of Freeport Reg. Water Project	0	Up to 15,000	EBMUD, Zone 7

(1) For the purposes of this study, SFPUC includes retail customers and the 28 wholesale customers, BAWSCA member agencies.

(2) SFPUC is a potential partner for supply reliability benefits, and because they own and operate Calaveras Reservoir.

4.3.1.1 Surface Water Storage

Los Vaqueros Reservoir Expansion

The Los Vaqueros Reservoir Expansion concept would involve an increase in capacity from the existing size of 100,000 AF. The CALFED Los Vaqueros Reservoir Expansion Studies Team is evaluating two reservoir capacities (300,000 AF and 500,000 AF), two diversion capacities (1,000 cfs and 1,750 cfs) and different operating modes. Water quality benefits are provided in all cases.

For CCWD, water quality generally improves in all year types. For the SBA Contractors, the Los Vaqueros Expansion generally improves SBA source water quality in all year types. This concept may also help Zone 7 Del Valle and Patterson Pass Water Treatment Plants meet theTHM4 target in D/DBP2 rule.

TABLE 4-7. Average Projected Source Water Quality Improvements with Los Vaqueros Reservoir Expansion Concept[1]

Agency	TOC (mg/L)		TDS (mg/L)		Bromide (mg/L)	
	Baseline	Concept	Baseline	Concept	Baseline	Concept
Critical Year						
CCWD	4.0	3.9	580	384	0.43	0.26
SBA Contractors[2]	5.1	3.9	507	221	0.37	0.12
SFPUC[3]	TBD					
Extended Dry Year						
CCWD	3.8	3.8	370	243	0.25	0.19
SBA Contractors[2]	3.7	3.6	384	253	0.26	0.15
SFPUC[3]	TBD					
Average Year						
CCWD	3.7	3.7	273	299	0.17	0.14
SBA Contractors[2]	4.0	3.2	296	218	0.19	0.12
SFPUC[3]	TBD					

[1] Concentrations are average monthly values for each agency and hydrology.

[2] Water quality benefits/impacts are assessed upstream of Zone 7. Affected South Bay Contractors include: ACWD, SCVWD and Zone 7.

[3] SFPUC water quality benefits and/or impacts will depend upon quantity and mechanism of deliveries, and may be evaluated in future studies. For the purposes of this study, SFPUC includes retail customers and the 28 wholesale customers, BAWSCA member agencies.

Calaveras Reservoir Expansion

Two operational scenarios are being considered for the Calaveras Reservoir expansion: 1) a water quality and dry-year supply reliability operational scenario, where up to 50,000 AFY would be delivered to South Bay Aqueduct contractors ACWD and SCVWD during average years, via a new connection to the SBA, and up to 41,000 AFY could be delivered to SFPUC (retail and wholesale customers, BAWSCA members), SCVWD and ACWD in dry years and up to 50,000 AFY in average years; and 2) a dry-year supply reliability scenario in which SFPUC (retail and wholesale customers, BAWSCA members), SCVWD and ACWD would potentially receive up to 53,000 AFY.

The water quality and supply reliability operation of the Calaveras Reservoir Expansion concept generally improves SBA water quality in all year types, as shown in Table 4-8. This option is expected to have minimal effect on SFPUC water quality.

TABLE 4-8. Average Projected Source Water Quality Improvements with Calaveras Reservoir Expansion Concept (Water Quality and Dry Year Reliability Scenario)(1)

Agency	TOC (mg/L)		TDS (mg/L)		Bromide (mg/L)	
	Baseline	Concept	Baseline	Concept	Baseline	Concept
Critical Year						
SBA Contractors(2)	5.1	4.0	507	312	0.37	0.21
Extended Dry Year						
SBA Contractors(2)	3.7	3.4	384	266	0.26	0.17
Average Year						
SBA Contractors(2)	4.0	3.3	296	182	0.19	0.10

(1) Concentrations are average monthly values for each agency and hydrology.

(2) Water quality benefits/impacts are assessed downstream of Zone 7. Affected South Bay Contractors include: ACWD and SCVWD.

The water supply reliability operation of the Calaveras Reservoir Expansion concept improves SBA water quality in critical droughts and extended dry periods. This option provides more benefit for water quality during the critically dry and extended dry periods than the previous operation due to the higher blending ratio, but does not provide benefit during average years. Projected source water quality is presented in Table 4-9.

Table 4-9. Average Projected Source Water Quality Improvements with Calaveras Reservoir Expansion Concept (Dry Year Reliability Scenario)(1)

Agency	TOC (mg/L)		TDS(mg/L)		Bromide (mg/L)	
	Baseline	Concept	Baseline	Concept	Baseline	Concept
Critical Year						
SBA Contractors(2)	5.1	3.8	507	285	0.37	0.19
Extended Dry Year						
SBA Contractors(2)	3.7	3.3	384	249	0.26	0.16
Average Year						
SBA Contractors(2)	4.0	NA	296	NA	0.19	NA

(1) Concentrations are average monthly values for each agency and hydrology.

(2) Water quality benefits/impacts are assessed downstream of Zone 7. Affected South Bay Contractors include: ACWD and SCVWD.

4.3.1.2 Enhanced Conservation

The Enhanced Conservation Concept includes activities that are not currently projected to be cost-effective within the study timeframe. Because the supply quantity from this concept has not been identified as part of this study, detailed information regarding potential benefits from this concept has not been established, and will be developed as part of the WUE 4-year evaluation.

4.3.1.3 Recycled Water Concepts

Twenty-six water recycling concepts, with a combined yield of up to 97,000 AFY, have been carried forward for detailed evaluation in the Program. Because potable supplies offset by the recycled water supply are assumed to meet demand, and are not available for exchange between agencies, there is no water quality element associated with these concepts.

4.3.1.4 Desalination

Desalination – Regional Desalination Project

The Bay Area Regional Desalination Project is intended to improve supply reliability for customers served by partner agencies by developing a desalination plant, or plants, at a site, or sites, which will provide benefit, either directly or indirectly, to each of the agencies that choose to participate. Because this supply quantities and allocations will be determined as part of the RDP, and are not included in this analysis, potential water quality benefits from this concept cannot be developed at this time, and will be determined in future phases of the RDP.

Mirant Desalination with Water Quality Element

This concept involves conveyance of up to 25 MGD (up to 15,000 AFY) of desalinated water in average years from the Mirant Pittsburg Power Plant, in Pittsburg, or the Mirant Contra Costa Power Plant in Antioch (dependent upon RDP), to Zone 7 for water quality blending.

This concept assumes that Mirant supplies are blended with EBMUD Mokelumne Aqueduct supplies and treated prior to delivery to Zone 7. Based on the relatively small quantity of Mirant supply being blended with Mokelumne supplies, this concept should have minimal impact to EBMUD for both water quality and water supply. It will have a potentially larger effect on Zone 7 due to supply blending ratios and improve water quality. During the average year conditions when supply may be available to Zone 7, improved water quality would be available compared to the SBA water quality. Projected water quality is presented in Table 4-10.

TABLE 4-10. Average Projected Water Quality of the Mirant Desalination with Water Quality Element Concept(1)

	TOC (mg/L)		*TDS (mg/L)*		*Bromide (mg/L)*	
Agency	*Baseline*	*Concept*	*Baseline*	*Concept*	*Baseline*	*Concept*
Critical Year						
EBMUD(2)	2.7	NA	80	NA	0.03	NA
Zone 7	5.1	NA	507	NA	0.37	NA
Extended Dry Year						
EBMUD(2)	1.8	NA	55	NA	0.02	NA
Zone 7	3.7	NA	384	NA	0.26	NA
Average Year						
EBMUD(2)	1.0	0.9	35	36	0.01	0.01
Zone 7	4.0	0.4	296	55	0.19	0.01

(1) Concentrations are average monthly values for each agency and hydrology.

(2) Mirant water quality projections represent the quality of the Mokelumne-Mirant blend after treatment by EBMUD. For the purposes of this study, Mirant Desalination permeate TDS was approximated as average Freeport TDS. Actual permeate water quality will be determined by the RDP.

Near Bay Bridge Desalination with Water Quality Element

This concept would involve conveyance of up to 10,000 AFY of desalinated water in average years from the Near Bay Bridge Desalination facility in Oakland (dependent upon RDP), to Zone 7 for water quality blending.

During the average year conditions when supply may be available to Zone 7, improved water quality would be available compared to the SBA water quality. Projected water quality is presented in Table 4-11.

TABLE 4-11. Average Projected Water Quality of the Near Bay Bridge Desalination with Water Quality Element Concept(1) (2)

Agency	TOC (mg/L)		TDS (mg/L)		Bromide (mg/L)	
	Baseline	Concept	Baseline	Concept	Baseline	Concept
Critical Year						
EBMUD	2.7	NA	80	NA	0.03	NA
Zone 7	5.1	NA	507	NA	0.37	NA
Extended Dry Year						
EBMUD	1.8	NA	55	NA	0.02	NA
Zone 7	3.7	NA	384	NA	0.26	NA
Average Year						
EBMUD	1.0	0.08	35	150	0.01	0.11
Zone 7	4.0	0.08	296	150	0.19	0.11

(1) Concentrations are average monthly values for each agency and hydrology.

(2) Near Bay Bridge water quality projections represent the quality of the Desalinated product water.

South Bay Desalination

The South Bay Desalination concept would involve construction of up to three desalination plants in Santa Clara County (Pico Power Plant in Santa Clara, Los Esteros Power Plant in San Jose, and the Palo Alto Regional Water Quality Control plant (WQCP) in Palo Alto), each with an intake capacity of up to 5 MGD.

Water quality benefits were only assumed for concepts that could potentially offset SCVWD surface water or groundwater. The water quality from the potable end use facilities is projected to be very good, and can be seen in Table 4-12.

TABLE 4-12. Average Projected Water Quality of the South Bay Desalination Concept (Potable Use) (1)

Agency	TOC (mg/L)		TDS (mg/L)		Bromide (mg/L)	
	Baseline	Concept	Baseline	Concept	Baseline	Concept
Critical Year						
SCVWD	5.1	0.6	507	160	0.37	0.08
SFPUC(2)	1.9		25		0.01	
Extended Dry Year						
SCVWD	3.7	0.6	384	160	0.26	0.08
SFPUC(2)	2.0		42		0.02	
Average Year						
SCVWD	4.0	0.6	296	160	0.19	0.08
SFPUC(2)	1.7		40		0.01	

(1) Concentrations are average monthly values for each agency and hydrology.

(2) For the purposes of this study, SFPUC includes retail customers and the 28 wholesale customers, BAWSCA member agencies.

East Bay Saline Groundwater Desalination

The East Bay Saline Groundwater Desalination Facility would involve location of a 10 to 15 MGD (treated production capacity) desalination plant in Newark or Fremont, California, for the purpose of desalinating non-potable, saline water from the saline portion of the Newark Aquifer. For treatment, this study assumed a finished water TDS similar to that of SFPUC's blended Hetch Hetchy and Sunol Valley Water Treatment Plant supplies.

Water quality from this concept is projected to be good and at 16,000 AFY could offset as much as 44 percent of the supply from the SBA if connected directly to the ACWD system. Projected water quality from the East Bay Saline Groundwater Desalination facility is presented in Table 4-13.

TABLE 4-13. Average Projected Water Quality of the East Bay Saline Groundwater Desalination Concept(1)

Agency	TOC (mg/L)		TDS (mg/L)		Bromide (mg/L)	
	Baseline	Concept	Baseline	Concept	Baseline	Concept
Critical Year						
SBA Contractors(2)	5.1	0.2	507	40	0.37	0.03
SFPUC(3)	1.9		25		0.01	
Extended Dry Year						
SBA Contractors(2)	3.7	0.2	384	40	0.26	0.03
SFPUC(3)	2.0		42		0.02	
Average Year						
SBA Contractors(2)	4.0	0.2	296	40	0.19	0.03
SFPUC(3)	1.7		40		0.01	

(1) Concentrations are average monthly values for each agency and hydrology.

(2) Affected South Bay Contractors include: ACWD, SCVWD.

(3) For the purposes of this study, SFPUC includes retail customers and the 28 wholesale customers, BAWSCA member agencies.

4.3.1.5 Conveyance

Bay Area Use of Freeport Regional Water Project

The Bay Area Use of the Freeport Regional Water Project involve conveyance of up to 25 MGD through the Freeport facilities and EBMUD system to Zone 7 for water quality blending.

Although EBMUD is evaluating several options for delivery of Freeport water, this study has assumed that Freeport water would be blended in the Mokelumne Aqueduct, and the blend treated at EBMUD's water treatment plants. With this configuration, this concept has a small water quality impact on EBMUD water – blending only 15,000 AFY with 260,000 AFY (5%) of Mokelumne water. For Zone 7 this quantity is approximately twenty percent of the average year SBA supply, and if blended could provide a significant improvement in average years, as shown in Table 4-14.

TABLE 4-14. Average Projected Water Quality of the Bay Area Use of the Freeport Regional Water Project Concept(1) (2)

Agency	TOC (mg/L)		TDS (mg/L)		Bromide (mg/L)	
	Baseline	Concept	Baseline	Concept	Baseline	Concept
Critical Year						
EBMUD	2.7	NA	80	NA	0.03	NA
Zone 7	5.1	NA	507	NA	0.37	NA
Extended Dry Year						
EBMUD	1.8	NA	55	NA	0.02	NA
Zone 7	3.7	NA	384	NA	0.26	NA
Average Year						
EBMUD	1.0	1.0	35	39	0.01	0.01
Zone 7	4.0	0.5	296	59	0.19	0.01

(1) Concentrations are average monthly values for each agency and hydrology.

(2) Concept water quality projections for EBMUD and Zone 7 represent the quality of the Freeport-Mokelumne blend before and after treatment by EBMUD, respectively.

4.3.2 Example Portfolios

The concepts were combined to form example portfolios that would provide different levels of water quality and water supply improvement. These five example portfolios and the main objectives for each are as follows:

Portfolio I:	Maximize Water Quality
Portfolio II:	Maximize Supply Reliability with Storage
Portfolio III:	Maximize Supply Reliability including an Expanded Los Vaqueros Project
Portfolio IV:	Maximize Supply Reliability with an Enlarged Calaveras Reservoir
Portfolio V:	Maximize Supply Reliability without Storage

Table 4-15 presents the example portfolios and identifies each of the major concepts and their dry year supply quantities assumed for each portfolio.

TABLE 4-15 Example Portfolios

Concepts Included	***Yield[5]***		***Portfolio I: Max. Quality***	***Portfolio II: Max. Supply w/ Storage***	***Portfolio III: Max. Supply w/ ELV***	***Portfolio IV: Max. Supply w/ Calaveras***	***Portfolio V: Max. Supply w/o Storage***
	Dry Yr. Supply (AFY)	***Avg. Yr. Blending (AFY)***					
Los Vaqueros Reservoir Expansion	42,000	121,000	✓	✓	✓		
Calaveras Res. Exp. (max yield)	Up to 53,000	0		✓		✓	
Calaveras Res. Exp. (max quality)	Up to 41,000	Up to 50,000	✓				
Regional Desalination Project [1]	TBD	TBD		✓	✓	✓	✓
Mirant Desal w/ WQ Element	0	15,000	✓				
Near Bay Bridge Desal w/ WQ Element	0	10,000					
South Bay Desal (Up to 3 facilities)	Up to 13,000	Up to 8,000		✓	✓	✓	✓
East Bay Saline GW Desal	16,000	16,000		✓	✓	✓	✓
Bay Area Use of the Freeport Regional Water Project [2]	0	15,000					
Current and Planned Conserv. [3]	[180,000]	0	✓	✓	✓	✓	✓
Enhanced Conservation	NA	NA		✓	✓	✓	✓
RW Concepts [4]	up to 97,000	0		✓	✓	✓	✓

[1] For portfolios including the RDP, yield totals do not include the yield from the RDP, which is projected to be up to 120,000 MGD, and will be determined in future phases of the RDP.

[2] Note: The Near Bay Bridge with Water Quality Element, Mirant Desalination with Water Quality Element, and Bay Area Use of the Freeport Regional Water Project all provide average year water quality benefits to Zone 7. However, all three concepts require the same available capacity in the Zone 7 and could not all go forward simultaneously. The Mirant Desalination with Water Quality Element concept was selected for inclusion in the Maximize Water Quality portfolio. This concept could be replaced with either the Bay Area Use of the Freeport Regional Water Project or Near Bay Bridge with Water Quality Element concepts to obtain similar average year water quality benefits for Zone 7.

[3] Current and Planned conservation consists of conservation activities including and extending beyond BMPs that are currently being implemented or planned to be implemented by the year 2020. This is considered part of baseline supply, and is not available in average years for blending or exchange.

[4] Recycled water projects yielding up to 91,752 AFY have been identified. Example portfolios including recycled water are assumed to include 50,000 AFY of recycled water supply originating from a subset of these projects. Specific projects to be implemented for each example portfolio have not been identified.

[5] Portfolio Yield quantities do not include yield from current and planned conservation.

Depending on the size of the individual concepts the portfolios could provide up to the following water supply and water quality benefits, not including enhanced conservation and the Regional Desalination Project. Table 4-16 summarizes these potential total quantities.

TABLE 4-16. Portfolio Range of Supply and Average Year Water Quality (Excludes Enhanced Conservation and Regional Desalination Project)

Concepts	Dry-Year Supply (AFY)	Average Year Water Quality (AFY)
I – Maximize Water Quality	Up to 83,000	Up to 186,000
II – Maximize Supply with Storage	Up to 221,000	Up to 145,000
III – Maximize Supply with Expanded Los Vaqueros	Up to 168,000	Up to 145,000
IV – Maximize Supply with Calaveras Reservoir	Up to 179,000	Up to 24,000
V – Maximize Supply without Storage	Up to 126,000	Up to 24,000

Portfolio 1: Maximize Water Quality

The Maximize Water Quality portfolio includes the Los Vaqueros Reservoir Expansion, Calaveras Reservoir Expansion (maximize water quality and supply reliability operation), and Mirant Desalination with Water Quality Element concepts. The projected source water quality benefits to participating agencies from this portfolio are summarized in Table 4-17.

TABLE 4-17. Average Projected Source Water Quality with the Maximize Water Quality Portfolio(1)

Agency	TOC (mg/L)		TDS (mg/L)		Bromide (mg/L)	
	Baseline	Concept	Baseline	Concept	Baseline	Concept
Critical Year						
ACWD	5.1	3.0	507	132	0.37	0.08
BAWSCA Agencies	N/A	N/A	N/A	N/A	N/A	N/A
CCWD	4.0	3.9	580	384	0.43	0.26
EBMUD	2.7	NA	80	NA	0.03	NA
SCVWD	5.1	3.0	507	132	0.37	0.08
SFPUC(2)	1.9	TBD[3]	25	TBD[3]	0.01	N/A
Zone 7	5.1	3.6	507	260	0.37	0.16
Extended Dry Year						
ACWD	3.7	3.2	384	195	0.26	0.11
BAWSCA Agencies	N/A	N/A	N/A	N/A	N/A	N/A
CCWD	3.8	3.8	370	243	0.25	0.19
EBMUD	1.8	NA	55	NA	0.02	NA
SCVWD	3.7	3.2	384	195	0.26	0.11
SFPUC(2)	1.9	TBD[3]	25	TBD[3]	0.01	N/A
Zone 7	3.7	3.6	384	288	0.26	0.18
Average Year						
ACWD	4.0	3.2	296	132	0.19	0.08
BAWSCA Agencies	N/A	N/A	N/A	N/A	N/A	N/A
CCWD	3.7	3.7	273	299	0.17	0.14
EBMUD	1.0	0.9	35	36	0.01	0.01
SCVWD	4.0	3.2	296	132	0.19	0.08
SFPUC(2)	1.9	TBD[3]	25	TBD[3]	0.01	N/A
Zone 7	4.0	3.2	296	200	0.19	0.11

(1) Benefits/impacts are to source water quality only. Values do not include distribution system concepts affecting treated water quality only; concentrations are average monthly values for each agency and hydrology.

(2) For the purposes of this study, SFPUC includes retail customers and the 28 wholesale customers, BAWSCA member agencies.

(3) SFPUC benefits/impacts associated with potential participation in the Los Vaqueros Reservoir Expansion to be determined in future studies.

Portfolio 2: Maximize Supply Reliability with Storage

The Maximize Supply Reliability with Storage portfolio includes the Los Vaqueros Reservoir Expansion, Calaveras Reservoir Expansion (maximize water supply reliability operation), the Regional Desalination Project, South Bay Desalination, East Bay Saline Groundwater Desalination, Enhanced Conservation, and Water Recycling concepts. The projected source water quality benefits to participating agencies from this portfolio are summarized in Table 4-18.

TABLE 4-18. Average Projected Source Water Quality with the Maximize Supply Reliability with Storage Portfolio(1)

	TOC (mg/L)		*TDS (mg/L)*		*Bromide (mg/L)*	
Agency	*Baseline*	*Concept*	*Baseline*	*Concept*	*Baseline*	*Concept*
Critical Year						
ACWD	5.1	2.9	507	144	0.37	0.07
BAWSCA Agencies	N/A	N/A	N/A	N/A	N/A	N/A
CCWD	4.0	3.9	580	384	0.43	0.26
EBMUD	2.7	N/A	80	N/A	0.03	N/A
SCVWD	5.1	2.9	507	144	0.37	0.07
SFPUC(2)	1.9	2.0	25	31	0.01	0.02
Zone 7	5.1	3.6	507	259	0.37	0.16
Extended Dry Year						
ACWD	3.7	3.1	384	173	0.26	0.10
BAWSCA Agencies	N/A	N/A	N/A	N/A	N/A	N/A
CCWD	3.8	3.8	370	243	0.25	0.19
EBMUD	1.8	N/A	55	N/A	0.02	N/A
SCVWD	3.7	3.1	384	173	0.26	0.10
SFPUC(2)	2.0	1.9	42	39	0.02	0.02
Zone 7	3.7	3.5	384	285	0.26	0.18
Average Year						
ACWD	4.0	2.9	296	144	0.19	0.07
BAWSCA Agencies	N/A	N/A	N/A	N/A	N/A	N/A
CCWD	3.7	3.7	273	299	0.17	0.14
EBMUD	1.0	N/A	35	N/A	0.01	N/A
SCVWD	4.0	2.9	296	144	0.19	0.07
SFPUC(2)	1.7	2.0	40	52	0.01	0.02
Zone 7	4.0	3.2	296	200	0.19	0.11

(1) Benefits/impacts are to source water quality only. Values do not include distribution system concepts affecting treated water quality only; concentrations are average monthly values for each agency and hydrology.

(2) For the purposes of this study, SFPUC includes retail customers and the 28 wholesale customers, BAWSCA member agencies.

Portfolio 3: Maximize Supply Reliability with Los Vaqueros Reservoir Expansion

The Maximize Supply Reliability with Los Vaqueros Reservoir Expansion portfolio includes the Los Vaqueros Reservoir Expansion, the Regional Desalination Project, South Bay Desalination, East Bay Saline Groundwater Desalination, Enhanced Conservation, and Water Recycling concepts. The projected source water quality benefits to participating agencies from this portfolio are summarized in Table 4-19.

TABLE 4-19. Average Projected Source Water Quality with the Maximize Supply Reliability with Los Vaqueros Reservoir Expansion Portfolio(1)

Agency	TOC (mg/L)		TDS (mg/L)		Bromide (mg/L)	
	Baseline	Concept	Baseline	Concept	Baseline	Concept
Critical Year						
ACWD	5.1	3.9	507	221	0.37	0.12
BAWSCA Agencies	N/A	N/A	N/A	N/A	N/A	N/A
CCWD	4.0	3.9	580	384	0.43	0.26
EBMUD	2.7	N/A	80	N/A	0.03	N/A
SCVWD	5.1	3.9	507	221	0.37	0.12
SFPUC(2)	1.9	N/A	25	N/A	0.01	N/A
Zone 7	5.1	3.9	507	221	0.37	0.12
Extended Dry Year						
ACWD	3.7	3.6	384	253	0.26	0.15
BAWSCA Agencies	N/A	N/A	N/A	N/A	N/A	N/A
CCWD	3.8	3.8	370	243	0.25	0.19
EBMUD	1.8	N/A	55	N/A	0.02	N/A
SCVWD	3.7	3.6	384	253	0.26	0.15
SFPUC(2)	2.0	N/A	42	N/A	0.02	N/A
Zone 7	3.7	3.6	384	253	0.26	0.15
Average Year						
ACWD	4.0	3.2	296	218	0.19	0.12
BAWSCA Agencies	N/A	N/A	N/A	N/A	N/A	N/A
CCWD	3.7	3.7	273	299	0.17	0.14
EBMUD	1.0	N/A	35	N/A	0.01	N/A
SCVWD	4.0	3.2	296	218	0.19	0.12
SFPUC(2)	1.7	N/A	40	N/A	0.01	N/A
Zone 7	4.0	3.2	296	218	0.19	0.12

(1) Benefits/impacts are to source water quality only. Values do not include distribution system concepts affecting treated water quality only; concentrations are average monthly values for each agency and hydrology.

(2) For the purposes of this study, SFPUC includes retail customers and the 28 wholesale customers, BAWSCA member agencies.

Portfolio 4: Maximize Supply Reliability with Calaveras Reservoir Expansion

The Maximize Supply Reliability with Calaveras Reservoir Expansion portfolio includes the Calaveras Reservoir Expansion, the Regional Desalination Project, South Bay Desalination, East Bay Saline Groundwater Desalination, Enhanced Conservation, and Water Recycling concepts. The projected source water quality benefits to participating agencies from this portfolio are summarized in Table 4-20.

TABLE 4-20. Average Projected Source Water Quality with the Maximize Supply Reliability with Calaveras Reservoir Expansion Portfolio[1]

Agency	TOC (mg/L)		TDS (mg/L)		Bromide (mg/L)	
	Baseline	Concept	Baseline	Concept	Baseline	Concept
Critical Year						
ACWD	5.1	3.0	507	285	0.37	0.08
BAWSCA Agencies	N/A	N/A	N/A	N/A	N/A	N/A
CCWD	4.0	N/A	580	N/A	0.43	N/A
EBMUD	2.7	N/A	80	N/A	0.03	N/A
SCVWD	5.1	3.0	507	285	0.37	0.08
SFPUC[2]	1.9	2.0	25	31	0.01	0.02
Zone 7	5.1	N/A	507	N/A	0.37	N/A
Extended Dry Year						
ACWD	3.7	3.2	384	249	0.26	0.11
BAWSCA Agencies	N/A	N/A	N/A	N/A	N/A	N/A
CCWD	3.8	N/A	370	N/A	0.25	N/A
EBMUD	1.8	N/A	55	N/A	0.02	N/A
SCVWD	3.7	3.2	384	249	0.26	0.11
SFPUC[2]	2.0	1.9	42	39	0.02	0.02
Zone 7	3.7	N/A	384	N/A	0.26	N/A
Average Year						
ACWD	4.0	3.0	296	182	0.19	0.08
BAWSCA Agencies	N/A	N/A	N/A	N/A	N/A	N/A
CCWD	3.7	N/A	273	N/A	0.17	N/A
EBMUD	1.0	N/A	35	N/A	0.01	N/A
SCVWD	4.0	3.0	296	182	0.19	0.08
SFPUC[2]	1.7	2.0	40	52	0.01	0.02
Zone 7	4.0	N/A	296	N/A	0.19	N/A

(1) Benefits/impacts are to source water quality only. Values do not include distribution system concepts affecting treated water quality only; concentrations are average monthly values for each agency and hydrology.
(2) For the purposes of this study, SFPUC includes retail customers and the 28 wholesale customers, BAWSCA member agencies.

Portfolio 5: Maximize Supply Reliability without Storage

The Maximize Supply Reliability without Storage portfolio includes the Regional Desalination Project, South Bay Desalination, East Bay Saline Groundwater Desalination, Enhanced Conservation, and Water Recycling concepts. No changes to source water quality are projected from this portfolio.

4.4 GENERAL CONCLUSIONS

As part of the detailed analysis, several general conclusions have been developed. These conclusions/findings include changes since the original Phase 1 of the Program, and are described in this section.

1. A regional approach to addressing water quality and water supply is complex;
2. Viable actions exist, but there is no simple solution for water quality and water supply;
3. Improvements to water quality in the Delta will be necessary to meet the long-term objectives of "Equivalent Level of Public Health" protection.

4.4.1 Regional Approach to Addressing Water Quality and Water Supply Is Complex

The factors that make planning on an individual utility level complex (e.g., multiple objectives that sometimes conflict, stakeholders with different priorities and perspectives, uncertainties in future realities and requirements, etc.) are multiplied when a regional approach is undertaken. At a regional level, multiple parties (each implicitly representing their own set of stakeholders) come together with different interests and objectives, different expectations as to the level of benefits expected to accrue from various projects, needs that vary in urgency, and agency-specific constraints which must be respected and ultimately become constraints for the universe of alternatives. In addition, there is the challenge of keeping all parties involved and engaged as other issues arise and uncertainties surrounding the successful outcome of a regional approach appear more daunting than those associated with individual agency actions.

The increased level of complexity has resulted in a broadening of the original program objectives beyond those articulated in the Phase 1 work. In particular, the interplay between water quality and supply challenges became readily apparent. Agencies with water quality challenges need improvement primarily in dry years, since it is during those periods that the poorest water quality is experienced. Agencies with high quality water are all supply-limited, particularly in dry years. As a result, regional water quality opportunities are limited unless supply is also a component.

Due to the interdependent nature of the challenges facing Bay Area water systems, it became necessary in Phase 2 to develop broader and more encompassing shared objectives that expanded upon the original objective of water quality improvement, including considerations such as water supply reliability, public health protection, cost, regional control, environmental impacts and implementation potential. Performance measures were then developed to capture the degree to which the concepts and portfolios achieved these broader objectives.

As the objectives of the Program were broadened in Phase 2 to more appropriately address the complex challenges facing the Bay Area water suppliers, the scope was expanded from the original Phase I Bay Area Blending and Exchange project to include water supply alternatives. Once a comprehensive list of alternatives were developed, options were subsequently narrowed based on the agency ground rules established in the Memorandum of Understanding (Appendix A of this document):

- Alternatives must include at least two participating agencies as beneficiaries
- Alternatives must conform to institutional and operational constraints (e.g. water rights)
- Alternatives must maintain consistency with other ongoing studies
- Alternatives must be acceptable to potential owning agencies (potential owning agencies retain the right to exclude alternatives).

4.4.2 Viable Actions Exist, But There is No Simple Solution for Water Quality and Water Supply

Concepts evaluated in the study, alone or in concert, are not sufficient to achieve the numeric CALFED ROD target of 50 µg/L bromide, and 3.0 mg/L TOC for diverters from the Delta. Further, enhanced conservation and water recycling, while important elements of a comprehensive water quality and water supply program, are not sufficient to solve the Bay Area's water quality and water supply challenges alone.

The study underscores the need for a broad array of actions, including actions outside this study to meet water quality and supply reliability objectives, such as:

- Treatment optimization and improvement strategies (local)
- Implementation of specific elements of agency integrated water resource plans
- Continuation of promising regional programs (e.g., Bay Area Regional Water Recycling Program (BARWRP) and Regional Desalination Project) and supplementation with greater levels of recycling, conservation, water banking, desalination, etc, by individual agencies.
- Improvements to water quality in the Delta

4.4.3 Improvements to Water Quality in the Delta will be Necessary to Meet the Long-Term Objectives of ELPH

The concepts alone, or even in combinations to form portfolios, cannot meet the CALFED ROD numeric target of 50 µg/L of bromide and 3.0 mg/L of TOC, indicating that improvements in Delta source water quality will be necessary to meet these long-term objectives in the ROD. As the ELPH concept (i.e., "Equivalent Level of Public Health" protection) is further developed and refined by CALFED, the extent of the necessary water quality improvement actions will become better defined.

The portfolio that provides the most water quality benefit is the Maximize Water Quality portfolio, which includes the Los Vaqueros Reservoir Expansion, Calaveras Reservoir Expansion (water quality and supply reliability operation), and Mirant Desalination with Water Quality Element concepts. Even with this portfolio, the CALFED ROD bromide and TOC source water quality numeric targets are not achieved. Although all participating agencies would be beneficiaries in this portfolio, the greatest water quality benefits are to the South Bay Aqueduct contractors ACWD, SCVWD, and Zone 7 Water Agency. Table 4-21 summarizes estimated bromide and TOC reductions for these agencies through implementation of this portfolio.

TABLE 4-21. Estimated Improvement in SBA Source Water TOC and Bromide Concentrations with Implementation of Maximize Water Quality Portfolio (1,2)

SBA Contractor	TOC Concentration (mg/L)		Bromide Concentration (µg/L)	
	Baseline (no portfolio)	With Maximize Water Quality Portfolio	Baseline (no portfolio)	With Maximize Water Quality Portfolio
Critical Year				
ACWD	5.1	3.0	370	80
SCVWD	5.1	3.0	370	80
Zone 7	5.1	3.6	370	160
Extended Dry Year				
ACWD	3.7	3.2	260	110
SCVWD	3.7	3.2	260	110
Zone 7	3.7	3.6	260	180
Average Year				
ACWD	4.0	3.2	190	80
SCVWD	4.0	3.2	190	80
Zone 7	4.0	3.2	190	110

(1) Concentrations are averages of monthly values for each agency and hydrology.

(2) Zone 7 is not a potential partner of the Calaveras Reservoir Expansion. However, adding the Calaveras Reservoir Expansion supply in conjunction with the Los Vaqueros Reservoir Expansion allows a portion of the SBA water normally conveyed via HOB Pumping Plant to be offset by the higher quality Los Vaqueros Reservoir supplies in some months. In those months only, Zone 7 receives an indirect water quality improvement.

In critical years, implementation of the Maximize Water Quality portfolio could potentially reduce average TOC for ACWD and SCVWD to the ROD target of 3.0 mg/L. However, this target is not achieved for extended dry or average hydrologies, and is not achieved by Zone 7 in any year type. Similarly, the ROD target of 50 µg/L bromide is not achieved for any SBA contractor in any hydrology.

Capital costs cannot be developed for all of the concepts in this portfolio at this time. However, based on the planning-level capital costs that have been developed, the projected costs associated with implementation of this portfolio are projected to greatly exceed \$2 billion, with operating costs in excess of \$32 million per year[3]. In the context of the limited returns expected from implementation of this portfolio, these costs are likely to be viewed as prohibitive, and an integrated approach that combines additional improvements to source water quality in the Delta, treatment strategies, and some combination of the concepts in this study will be required to provide an equivalent level of public health protection to the numeric bromide and TOC targets in the ROD.

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[3] CALFED Los Vaqueros Expansion Studies (CALFED, 2004) project capital costs of \$1,514 million and operating costs of \$27.5 million (\$2008). Capital, operating, and life-cycle costs for RDP elements to be determined as part of RDP. Conceptual-level Zone 7 intertie costs are estimated at \$24 million (\$2005). Operational costs for the Mirant Desalination with Water Quality Element concept have not been estimated. Zone 7 life-cycle costs would need to consider capital, operating and potential buy-in/wheeling fees. Calaveras capital costs are estimated at \$426 million (\$2003), with operating costs estimated as \$3.5 million per year (\$2004). Capital costs for the Calaveras Reservoir Expansion include new dam, spillway, outlet works (Contingency Action Plan for Calaveras Dam Evaluations, URS, 01/2003), pipelines from reservoir to SVWTP, from SVWTP to pump station and from Calaveras to SBA, pump station, power, pressure reducing station. Pumping costs estimated as \$3.5 million/year. Operating costs and annualized costs associated with the Calaveras Reservoir Expansion concept to be determined as part of future SFPUC studies.

4.5 AGENCY NEXT STEPS

The Program has provided a preliminary evaluation of the retained concepts and example portfolios in detail with respect to their performance in improving supply reliability, protecting the public health and minimizing environmental impacts for the participating agencies. The group of concepts evaluated by the Program represents a subset of the water supply reliability and water quality alternatives available to the participating agencies, with the common thread being a regional approach to water resources improvements. The list of retained concepts is not intended to be an exhaustive list of alternatives. Further, agencies identified as potential beneficiaries of Program concepts have not committed to perform additional studies of those concepts beyond the information presented in this report, nor have they committed to implement concepts at any time in the future. It is also possible that there may be additional beneficiaries identified for project concepts as further evaluation is performed and project concepts are modified. Similarly, the example portfolios included in the Program represent five possible combinations of the concepts retained in the Program. No detailed alternatives analysis has been performed to optimize concept combinations and achieve superior portfolios for any or all participating agencies. All participating agencies have been identified as potential beneficiaries for all portfolios; however, no agencies have committed to future studies or implementation of any or all example portfolios.

Each participating agency has water supply reliability and water quality challenges unique to that agency. As such, each participating agency has unique priorities for developing water resources strategies, and a specific system for deciding between competing water resources alternatives. Each objective and performance measure against which the Program concepts and example portfolios have been evaluated will carry a different significance for each participating agency, based on these differences in priorities and value systems. The degree to which concepts and example portfolios address the unique challenges specific to each agency differ, and the perceived value of concept implementation will similarly differ by agency as well.

The scorecards developed for the Program are intended to provide the participating agencies with quantitative and qualitative information to aid decision-making processes. The information provided in the scorecards should be used by each agency to determine whether a given concept or example portfolio merits further attention and study by the agency. Some concepts, including the RDP and Los Vaqueros Reservoir Expansion, are already included in ongoing studies. For other concepts, the scorecards may help an agency decide if concept(s) and/or example portfolios could provide benefit and/or merit further attention.

Determinations of what concepts and example portfolios are most beneficial will be left to the individual participating agencies, to be informed by the analysis developed in the Program.

This study was conducted at a pre-feasibility level to determine which, if any, concepts considered merit further attention by some or all participating agencies. The analysis contained in this document and its appendices is similarly at a pre-feasibility level, and is not intended to be a comprehensive water quality and/or supply reliability analysis. Upon deciding that concept(s) and/or portfolio(s) merit additional study, detailed analysis will still need to be performed by the interested agencies. The additional steps to concept and/or portfolio evaluation that may potentially be pursued by participating agencies are described below.

If the concept or example portfolio is considered to merit additional study:

- Additional conceptual-level engineering evaluations, including assessment of facility alternatives, costs and refinement of water quality and supply reliability benefits using detailed water supply and water quality modeling consistent with each agency's internal modeling;

- Detailed environmental impact assessments, including EIR/EIS development;

- Institutional and financial analysis to identify possible institutional structures for implementation, cost-sharing and funding options, and associated participating agency costs and benefits.

If the concept or example portfolio is not considered to merit additional study:

- No additional analysis will be pursued and the concept or example portfolio will not advance.

Appendix A

Project MOU

MEMORANDUM OF UNDERSTANDING

among the

CALIFORNIA DEPARTMENT OF WATER RESOURCES,
CALIFORNIA DEPARTMENT OF HEALTH SERVICES,
US BUREAU OF RECLAMATION, US ENVIRONMENTAL PROTECTION AGENCY,

CONTRA COSTA WATER DISTRICT,
EAST BAY MUNICIPAL UTILITY DISTRICT,
SANTA CLARA VALLEY WATER DISTRICT,
CITY AND COUNTY OF SAN FRANCISCO PUBLIC UTILITIES COMMISSION,
ALAMEDA COUNTY WATER DISTRICT
ZONE 7 OF ALAMEDA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT, AND
SAN FRANCISCO BAY AREA WATER USERS ASSOCIATION

regarding

CALFED BAY-DELTA PROGRAM STUDIES FOR THE BAY AREA BLENDING AND EXCHANGE PROJECT

Pursuant to the CALFED Bay-Delta Programmatic Record of Decision for the Final Programmatic Environmental Impact Statement and Environmental Impact Report (hereafter, "ROD"), dated August 28, 2000, an agreement will be developed between several CALFED agencies including the California Department of Water Resources (hereafter, "DWR"), the California Department of Health Services (hereafter, “DHS”), US Bureau of Reclamation (hereafter, "Reclamation"), the US Environmental Protection Agency (hereafter, “EPA”); and potential Bay Area partners for the completion of necessary studies as part of a process to work cooperatively to address water quality and supply reliability concerns on a consensual basis consistent with the CALFED long-term comprehensive plan, including the solution principles and objectives.

Purpose. The purpose of this Memorandum of Understanding (MOU) is to memorialize the mutual willingness of the Parties to this MOU to share information as part of a process to work cooperatively to address water quality and supply reliability concerns on a consensual basis consistent with the CALFED Bay-Delta Programmatic Record of Decision, dated August 28, 2000 (page 69). Potential later phases of such projects, including, preliminary design, final design, financing and construction, are not covered by this MOU.

It is hereby recognized through this MOU that:

1. Water supply agencies in the Bay Area have different water sources and different water supply and quality concerns, as well as independent, ongoing programs and projects to address their respective water supply and quality concerns;

2. the CALFED Bay-Delta Program Programmatic Record of Decision recognized that local agencies will continue to independently develop storage and other projects to meet local needs;

3. the CALFED ROD states that CALFED agencies will pursue identified complementary actions, which will help achieve CALFED goals and objectives;

4. the CALFED ROD identified as a complementary action a Bay Area water quality and water supply reliability initiative called the Bay Area Blending/Exchange Project that would enable Bay Area water agencies to work cooperatively to address water quality and supply reliability concerns on a mutually beneficial and regionally focused basis;

5. to encourage a regional approach to water supply operations, the Bay Area Blending/Exchange Project will evaluate a range of options including, but not limited to, changes to infrastructure and institutional arrangements that are mentioned in the CALFED Record of Decision;

6. the CALFED ROD committed to the identification of potential local partners and development of an agreement as needed for necessary studies with those partners for the Bay Area Blending/Exchange Project by July 2001.

7. This MOU does not cover participation in any CALFED Bay Area - wide implementation strategy.

1. Definitions

(a) "Party" and "Parties" refer to the signatories to this MOU: DWR, DHS, Reclamation, and USEPA; and local Bay Area interests represented by the East Bay Municipal Utility District (EBMUD), the Santa Clara Valley Water District (SCVWD), the Alameda County Water District (ACWD), Zone 7 of Alameda County Flood Control and Water Conservation District (Zone 7), the Contra Costa Water District (CCWD), the City and County of San Francisco Public Utilities Commission (SFPUC), and the San Francisco Bay Area Water Users Association (BAWUA).

(b) “Study” and “Studies” mean the feasibility and environmental investigations of Bay Area Blending and Exchange projects pursuant to the ROD, including the preliminary project review that will include open and objective consideration of relevant operational, environmental, cultural, engineering, financial, legal, institutional and outreach issues. Parties will use the results of these studies to determine if any of the Parties are interested in pursuing any of the Bay Area Blending and Exchange projects.

(c) “Environmental review” means the development and completion of necessary feasibility studies, analyses, and documents pursuant to National Environmental Policy Act, California Environmental Quality Act, California Endangered Species Act, Federal Endangered Species Act, Natural Community Conservation Planning Act, and other state and federal environmental laws.

(d) “CALFED Bay-Delta Program” is a cooperative interagency effort of various State and federal agencies with management or regulatory responsibilities for the Bay-Delta. Actions undertaken by the ‘CALFED Program’ pursuant to this MOU will be performed by the CALFED agencies working through the CALFED Bay-Delta Program.

2. Underlying Principles

(a) Execution of this MOU for studies in no way implies support for or an obligation to approve, or participate financially or otherwise in any Bay Area Blending and Exchange projects identified through this study phase.

(b) Participation in this MOU and studies covered by this MOU is voluntary and any agency may withdraw at any time from this MOU by providing written notice to the other Parties. Participation in this MOU and related studies does not imply endorsement or commitment to implement the recommendations of the studies.

(c) The studies will be carried out in an inclusive manner that encourages voluntary participation by the Parties executing this MOU as well as other interested persons or organizations.

(d) Execution of this MOU is in no way intended to provide preferential treatment to any particular Bay Area Blending and Exchange project in obtaining authorization or funding to proceed to construction.

(e) A separate MOU has been developed to address an expansion of Los Vaqueros Reservoir. Execution of that MOU is not intended to adversely affect work for the Bay Area regional effort or any other project that may be studied or proposed by a Bay Area agency as part of the Bay Area Blending/Exchange Project or otherwise, nor is execution of this MOU intended to adversely affect work for the Los Vaqueros Expansion Studies or any other project that may be studied or proposed by a Bay Area agency as part of the Los Vaqueros Expansion Studies or otherwise.

(f) The commitments established in the ROD for the Bay Area Blending/ Exchange project and the expanded Los Vaqueros project, which have parallel commitments for preliminary studies, shall guide the schedule of work. No alteration in commitment dates is contemplated for either effort in these preliminary studies.

(g) Project elements of the studies should be designed to protect the environment consistent with overall CALFED ecosystem goals established in the ROD.

(h) Execution of this MOU or participation in the activities contemplated by this MOU in no way waives any legal or contractual rights of participating Parties.

(i) The governing boards of Bay Area water agency and water user association signatories will decide whether to proceed with implementation of recommendations from this study related to their water rights, water contracts, integrated resource plans, and infrastructure resulting from this MOU or associated studies.

(j) Execution of this MOU in no way limits the ability of water agency signatories to pursue individual projects or obtain separate federal and state funding.

(k) Unmitigated adverse impacts upon users or customers of the Bay Area water agencies, or customers of the Bay Area water agencies, or imposition of new health risks upon customers is not an acceptable outcome of the studies. No agencies or their customers are obligated by this MOU to accept adverse impacts.

(l) Characterization of water rights will be carried out with the Party holding the corresponding affected water right as the lead entity and with that Party's direct consultation and permission. Except to the extent that documentation of feasibility or infeasibility may be necessary to comply with alternatives analysis required by state and federal environmental laws, changes to existing water rights held by the EBMUD, the SFPUC, CCWD or other parties will not be considered in the Studies, and Mokelumne River water rights held by EBMUD, Tuolumne River water rights held by SFPUC, Delta water rights held by CCWD or water rights held by others will not be available to use for the Bay Area Blending/Exchange Project, without the express consent of EBMUD, SFPUC, CCWD or of other water rights holders respectively. It is the Parties' belief that consideration of such rights without the consent of EBMUD, SFPUC, CCWD and/or other parties will likely be deemed an infeasible alternative for institutional reasons.

(m) To the extent to which the studies explore or contemplate potential changes to water service contracts, or deliveries under those contracts, the Parties to the MOU who are parties to the contracts that would be changed shall reach agreement on how the contracts are characterized within the studies.

(n) Any studies of proposed interconnections between facilities owned by different agencies will be addressed in a manner satisfactory to all affected agencies.

(o) Any studies of proposed reoperation of facilities owned by different agencies will be addressed in a manner satisfactory to all affected agencies.

(p) The Studies shall be carried out in a manner to ensure that a full range of projects is evaluated, capable of providing a balanced set of water quality and water supply benefits to the participating Bay Area water districts, recognizing that the Bay Area Blending/Exchange Project is one component of the larger CALFED Program. An example of an unacceptable outcome is for one agency to have viable solutions identified for all of its needs while no solutions are identified for another. The Parties expect to discuss and develop specific measures to implement this principle during the course of the Studies.

3. Roles and Responsibilities of Parties

(a) While the Bay Area Blending and Exchange Project is identified as part of the Drinking Water Quality Program, it also has water supply reliability components and needs to be closely coordinated with other CALFED agency activities. Therefore, it will be managed by the CALFED Bay-Delta Program staff unless the Parties mutually agree that another agency should be the manager or co-manager. This MOU shall become effective upon its execution by at least one CALFED agency and by ACWD, CCWD, EBMUD, SCVWD, SFPUC, Zone 7 and BAWUA.

(b) The Parties executing this MOU will not be required to financially contribute toward costs of these studies.

(c) The manager of the Bay Area Blending and Exchange Project identified in paragraph 3(a) of this MOU is responsible for the completion and management of the studies. These studies will be consistent with Section 2.

(d) The manager of the Bay Area Blending and Exchange Project identified in paragraph 3(a) of this MOU shall insure that any tribes who may be affected by the potential Bay Area Blending and Exchange projects are involved early and fully in the studies consistent with the ROD.

(e) Each water right holder or facility owner participating in the studies will provide information on all matters pertaining to its water rights or facilities. CALFED will review this information for clarity, accuracy and consistency with the level of detail necessary for the Bay Area Blending and Exchange study and will work with parties to make sure that the best available information is used.

(f) When the studies are completed, the Parties to this MOU will reevaluate their interest in any proposed Bay Area Blending and Exchange Project based on the contents of the studies, and may at that time decline to participate further or may desire to change the contents of the MOU, or proceed to final agreements regarding participation, if a project is identified.

(g) The Parties to this MOU will establish a technical committee consisting of representatives from the Parties, including CALFED Bay-Delta Program staff in addition to staff from CALFED agencies, who will meet not less than three times per calendar year for the purposes of keeping other Parties informed, providing input, reviewing technical memoranda, and ensuring that interests and concerns are considered in the development of the studies. The manager of the Bay Area Blending and Exchange Project identified in paragraph 3(a) of this MOU is responsible for distributing meeting materials and draft work products in a timely manner to interested parties and providing timely responses to concerns raised. The technical committee will assist the manager in ensuring adequate completion and management of studies.

(h) The Parties to this MOU intend to ensure that the concepts of adaptive management and best available science will be incorporated into the studies and into any eventual project should a project be approved.

(i) The Parties to this MOU agree to provide data and other relevant information related to the completion of the studies in a timely fashion. Additionally, the Parties agree to participate in timely review and to provide comment on technical reports related to the completion of these studies. Such participation by any Party is subject to that Party's respective policy and legal direction, appropriations, authorization, and funding.

(j) Each Party shall designate at least one representative who shall be the lead contact for the organization and who, together with designated alternates, shall attend meetings of the technical committee described in Section 3(g). However, this participation is subject to appropriations and funding.

4. Outreach Responsibilities of the Parties

(a) Parties to this MOU and the CALFED Bay-Delta Program will be responsible for keeping non-participating CALFED Agencies and interested water users appraised of developments with respect to the results of the studies, subsequent agreements, and all other substantive matters related to the planning, construction and operation of potential Bay Area Blending and Exchange projects.

(b) Each Party to this MOU is responsible for keeping that Party’s respective constituencies appraised of developments with respect to the terms and conditions of this MOU, the results of the studies, subsequent agreements, and all other substantive matters related to the planning of potential Bay Area Blending and Exchange projects.

(c) Parties to this MOU and the CALFED Bay-Delta Program shall provide a forum to ensure that public outreach includes local governments, tribal governments, and non-participating local and statewide interests and stakeholders, including but not limited to local environmental protection groups, environmental justice groups, recreational interests, in-Delta interests, and the business community. Future project-level studies requiring subsequent agreements to this MOU will include a public involvement component to ensure public input on project-specific aspects. All materials prepared pursuant to the Bay Area Blending and Exchange project shall be presented at regularly scheduled Bay-Delta Public Advisory Committee meetings.

(d) Environmental justice refers to the fair treatment of people of all races, cultures, and income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Parties to this MOU will be responsible for ensuring that public outreach is conducted in a manner that promotes environmental justice and complies with relevant laws and regulations.

5. Funding and In-Kind Contributions

Funding for CALFED planning studies related to the Bay Area Blending and Exchange Project as outlined in the ROD will be provided by funds available to CALFED agencies as provided for in separate agreements. Future agreements shall also address how local monetary and "in-kind" contributions can be cost shared, subject to the availability of appropriations and funding.

6. Limitations of this MOU

Execution of this MOU does not in any way imply support for or an obligation to support, approve, or participate in any projects identified through this Phase of the Bay Area Blending and Exchange Project. No Party to this MOU is bound to any financial contribution related to these studies or participation in this or a related project, except as might be otherwise provided in separate agreements.

7. Contingent on Appropriation of Funds and Future Actions

(a) United States: The expenditure or advance of any money or the performance of any obligations of the United States under this MOU shall be contingent upon appropriation or allotment of funds in accordance with 31 U.S.C. 1341 (Anti-Deficiency Act). No liability shall accrue to the United States for failure to perform any obligation under this MOU in the event that funds are not appropriated or allotted.

(b) State of California: The commitments and obligations under this MOU of the State of California are subject to the availability of appropriated funds. No liability shall accrue to the State of California for failure to perform any obligations under this MOU in the event that funds are not appropriated.

(c) Legal consistency: All provisions of this MOU are intended and shall be interpreted to be consistent with all applicable provisions of State and Federal law.

8. Notices

All formal notices regarding the term of this MOU as detailed in Section 9 shall be sent to the following:

DWR:
Thomas M. Hannigan, Director
California Department of Water Resources
P.O. Box 942836, Room 1115-1
Sacramento, CA 94236-0001

DHS:
Terry Macaulay, CALFED Coordinator
California Department of Health Services
Office of Drinking Water Program
P.O. Box 942732, MS 92
Sacramento, CA 94234-7320

USBR:
Kirk Rodgers, Acting Director
Mid-Pacific Region, Bureau of Reclamation
U.S. Department of the Interior
2800 Cottage Way
Room East-1604, MP-100
Sacramento, CA 95825-1898

USEPA:
Karen Schwinn
United States Environmental Protection Agency
Region IX
75 Hawthorne Lane, WTR-1
San Francisco, CA 94105

Contra Costa Water District:
Walter J. Bishop, General Manager
Contra Costa Water District
PO Box H2O
Concord, CA 94524

East Bay Municipal Utility District:
Dennis Diemer, General Manager
East Bay Municipal Utility District
375 11th Street, MS 808
Oakland, CA 94607

Santa Clara Valley Water District:
Stan Williams, CEO
Santa Clara Valley Water District
5750 Almaden Expressway
San Jose, CA 95118

Alameda County Water District: Paul Piraino, General Manager
Alameda County Water District
P.O. Box 5110
43885 S. Grimmer Blvd.
Fremont, CA 94537

Zone 7 of Alameda County Flood
Control and Water Conservation
District: Dale Myers, General Manager
Zone 7 of Alameda Co. Flood Control and Water
Conservation District
5997 Parkside Drive
Pleasanton, CA 94588

City and County of San Francisco
Public Utilities Commission: Steven D. Leonard, Acting General Manager
San Francisco Public Utilities Commission
1155 Market Street 4th Floor
San Francisco CA 94102

San Francisco Bay Area Water
Users Association: Art Jensen, General Manager
San Francisco Bay Area Water Users Association
155 Bovet Road, Suite 302
San Mateo, CA 94402

CALFED Bay-Delta Program: Patrick Wright, Director
CALFED Bay-Delta Program
1416 Ninth Street, Suite 1155
Sacramento, CA 95814

9. Term and Modification Provisions

(a) This MOU shall become effective upon its execution by at least one CALFED agency and by ACWD, CCWD, EBMUD, SCVWD, SFPUC, Zone 7 and BAWUA. The Parties to this MOU will reevaluate their interest in the studies upon completion of feasibility studies (currently contemplated for July 2002) and may at that time decline to participate further or propose amendments to this MOU. Unless otherwise amended or affected by a CALFED long-term governance agreement or federal or State legislation, the MOU will expire on December 31, 2003 or whenever final agreements with project participants, as contemplated in the ROD, are executed, whichever comes first. The Parties recognize that additional agreements related to alternatives identified by the Studies and among the relevant parties with interests in that alternative, might involve environmental review and might extend and retain/include some elements of this MOU.

(b) At any time, this MOU may be extended or amended by mutual, written agreement of the Parties.

(c) At any time, any Party may withdraw from this MOU by simple written notice to the other Parties.

(d) Any state, federal, or local governmental agency with jurisdiction over land, water or natural resources in California may become a party to this MOU by executing a copy of this MOU. Such execution shall be by the agency's officers pursuant to authority conferred to do so by the governing body of the agency.

10. Counterparts

This MOU can be executed in counter parts, each of which shall be deemed an original, but all of which together shall constitute one and the same instrument.

IN WITNESS WHEREOF, the parties hereto have executed this Memorandum of Understanding.

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Dated: 7/24/01

By
Thomas M. Hannigan
Director

STATE OF CALIFORNIA
DEPARTMENT OF HEALTH SERVICES

Dated:

By
Diana M. Bontá
Director

UNITED STATES BUREAU OF
RECLAMATION, MID-PACIFIC REGION

Dated:

By Lowell F. Ploss
FOR Kirk Rodgers
Acting Director

UNITED STATES ENVIRONMENTAL
PROTECTION AGENCY, REGION IX

Dated: 7/27/2001

By Jane
for Laura Yoshii
Acting Regional Administrator

CONTRA COSTA WATER DISTRICT

Dated:

By Walter J. Bishop
Walter J. Bishop
General Manager

EAST BAY MUNICIPAL UTILITY DISTRICT

Dated:

By Dennis M. Diem RCH
Dennis Diemer
General Manager

SANTA CLARA VALLEY WATER DISTRICT

Dated: SEP 18 2001

By
Stanley M. Williams
CEO/General Manager

ALAMEDA COUNTY WATER DISTRICT

Dated:

By
Paul Piraino
General Manager

ZONE 7 OF ALAMEDA COUNTY FLOOD
CONTROL AND WATER CONSERVATION
DISTRICT

Dated: 8-21-01

By Dale Myers
Dale Myers
General Manager

Appendix B

Agency Supplies and Demands

B1. Overview of Water Supplies

Appendix B1
Overview of Water Supplies

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Appendix B1
Overview of Water Supplies

The purpose of this technical memorandum is to present a summary of water supplies and potential supplies within the study area. For the purposes of this project, the participating agencies include the following Bay Area water agencies: Alameda County Water District (ACWD), Bay Area Water Supply and Conservation Agency (BAWSCA); Contra Costa Water District (CCWD); East Bay Municipal Utility District (EBMUD); San Francisco Public Utilities Commission (SFPUC); Santa Clara Valley Water District (SCVWD); and Zone 7 Water Agency (Zone 7).

Summary

Sources of water supply for the study area include the following:

- State Water Project
- Central Valley Project
- Tuolumne River
- Mokelumne River
- Local Supplies (Groundwater + Surface Water)
- Other (Recycled Water + Transfers)

Sierra Nevada watersheds (e.g. Tuolumne and Mokelumne) account for approximately 43% of the water currently used in the study area. Local supplies, transfers and recycled water provide 33% of the water currently used in the study area, and state and federal supplies (e.g. SWP and CVP) provide about 24% of the water currently used in the study area.

This Technical Memorandum presents existing supplies available for each agency under differing hydrologic conditions. The BAWAC agencies have different methodologies for calculating available supply in the dry year scenarios, as defined by the Urban Water Management Planning Act. As a result, generic shortfall projections would not be consistent with individual agencies' planning assumptions, and could be misleading. Therefore, this Technical Memorandum does not present shortfalls. For further information on agency-specific projected shortfalls, please refer to agency documentation including (but not limited to): Urban Water Management Plans, Integrated Water Resource Plans, etc, for the agencies in question. The project team will be reviewing appropriate supply conditions to define future baseline conditions with each agency.

The analysis presented in this Technical Memorandum does not take into account any new water supply sources that may be developed after 2000.

Overview of Water Supplies Used in the Study Area

The following sections provide a general overview of the existing water supplies used by each of the water agencies within the study area.

Alameda County Water District (ACWD) Water Supplies

ACWD's three primary sources of water supply are the State Water Project, SFPUC, and local supplies.

1. State Water Project

ACWD has a maximum annual SWP allocation amount of 42,000 acre-feet (AF) from the State Water Project (SWP). The amount of SWP water actually delivered to ACWD in any given year is dependent upon: (1) hydrologic conditions; (2) requests by other SWP contractors; (3) SWP facility capacity; and (4) environmental/regulatory requirements.

2. SFPUC Supply

This supply includes water from the Tuolumne River as well as treated water produced by San Francisco Public Utilities Commission (SFPUC) facilities in the Alameda Creek Watershed. The maximum annual delivery of SFPUC water to ACWD is approximately 15,400 AF.

3. Local Water Supplies

The principal source of local supply is the local aquifer system known as the Niles Cone Groundwater Basin. Annual groundwater production has varied from 14,400 to 26,700 AF over the 1984-1999 period. ACWD also has rights to divert water for storage and has 7,500 acre-feet of storage capacity made available annually in the Del Valle Reservoir. ACWD has also constructed Northern California's first brackish groundwater desalination facility. This facility, which came on-line in September 2003, provides up to 5 million gallons per day (mgd), as much as 5,600 AFY of potable supply to the District's distribution system.

Table B1-1
ACWD Distribution[1] System Water Use by Supply Source (FY 2000-01)

Supply	*AFY*
State Water Project	26,400
SFPUC	13,000
Local Supplies	16,800
Total	**56,200**

[1] Distribution system use includes all water uses supplied by ACWD's treatment and production facilities, including residential, commercial, industrial, and other uses. It does not include approximately 15,300 AF of non-potable demands, primarily used for private groundwater pumping and local groundwater management.

A breakdown of fiscal year 2000-01 distribution system water use by source is presented in Table B1-1 and Figure B1-1. It should be noted that the supplies shown in Table B1-1 do not necessarily reflect the total supply available, just the amount used in FY 2000-01.

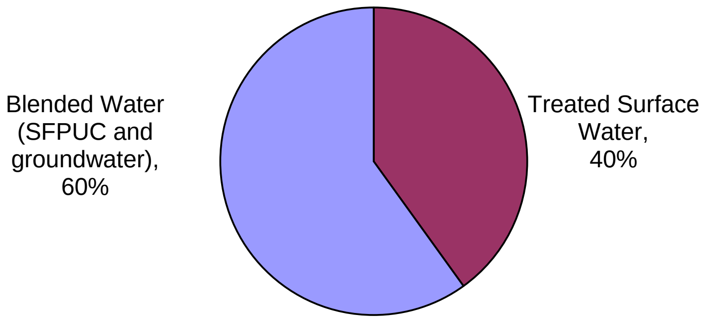

Figure B1-1
ACWD Distribution[1] System Water Use By Source
(FY 2000-2001)

Bay Area Water Supply and Conservation Agency (BAWSCA) Water Supplies

BAWSCA is comprised of the 28 cities, water districts and other water suppliers (located in Alameda, San Mateo and Santa Clara counties) that purchase all or a portion of their water from the City and County of San Francisco through the SFPUC. The primary sources of water supply used by BAWSCA member agencies include SFPUC supplies, groundwater, surface water and other supplies (e.g., recycled water and Santa Clara Valley Water District).

1. SFPUC Supplies

This supply includes water from the Tuolumne River as well as treated water produced by SFPUC facilities in the Alameda Creek and Peninsula Watersheds. The current SFPUC supply assurance for BAWSCA agencies is collectively 184 mgd.

2. Groundwater

Several groundwater basins underlie the service areas of BAWSCA agencies including the Westside Groundwater Basin, Santa Clara Groundwater Basin, and the Niles Cone Groundwater Basin. Therefore BAWSCA member agencies have access to groundwater, but the only agency with actual groundwater management responsibilities is ACWD. Annual groundwater production varies through the region. The groundwater basins are operated independent of each other but in conjunction with local and imported surface water supplies.

3. Surface Water

Some BAWSCA agencies have developed local surface water supplies, which are utilized in conjunction with the other supplies available to them. Yield from these local surface supplies varies considerably and is dependent upon hydrologic conditions and storage availability.

4. Other (SWP, CVP, Recycled Water)

Several BAWSCA agencies located in Santa Clara County access state and federal project water (SWP and CVP) through purchases from the Santa Clara Valley Water District (SCVWD). Another BAWSCA agency, ACWD, purchases water directly from the SWP. Currently, over 20% of the BAWSCA agencies utilize recycled water to meet a portion of existing water demands.

A breakdown of the typical total annual water supply utilized from each source is presented in Table B1-2 and Figure B1-2. It should be noted that the supplies shown in Table B1-2 do not necessarily reflect the total supply available, just the amount used in FY 2001-02.

Table B1-2
BAWSCA Water Use by Source (FY 2001-02)

Supply	***AFY***
SFPUC	191,000
Groundwater	42,800
Surface water	5,000
Other(1)	46,800
Total	**285,600**

(1) Other includes supplies from the SCVWD and recycled water.

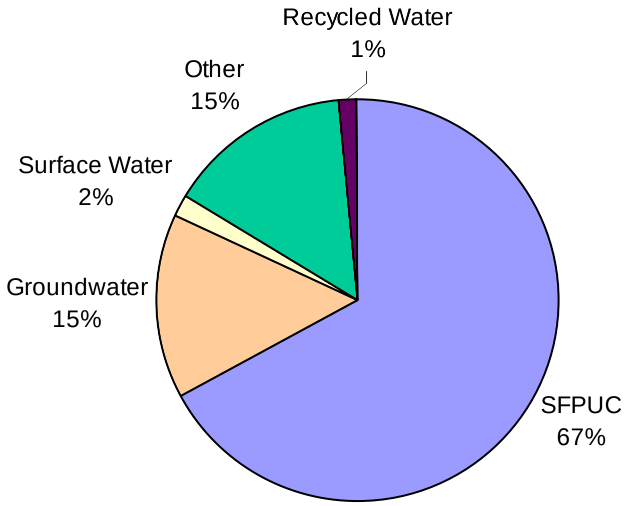

Figure B1-2
BAWSCA Members - Water Use By Source
(FY 2001-2002)

Contra Costa Water District (CCWD) Water Supplies

CCWD's primary sources of water supply include the Central Valley Project, Los Vaqueros, Mallard Slough, other delta supplies, recycled water, and water transfers.

1. Delta Supplies

a. Central Valley Project (CVP)

CCWD has a CVP contract for 195,000 AFY. This is the primary source of water supply for CCWD. The current contract specifies a minimum allotment to the District when the CVP is experiencing regulatory restrictions of the greater of 85 percent of its CVP "historical use" or 75 percent of its SWP allocation amount.

b. Los Vaqueros Water Right

The Los Vaqueros Water Right supply can be used in lieu of the CVP supply. When Los Vaqueros water rights water is used, CVP supplies are reduced by an identical amount. CCWD is permitted to divert up to 95,980 AFY of excess Delta flows to Los Vaqueros Reservoir for storage between November 1 of each year and June 30 of the succeeding year. The availability of Los Vaqueros Water Right water is limited in dry years.

c. Mallard Slough

The Mallard Slough supply can be used in lieu of the CVP supply. When Mallard Slough water rights water are used, CVP supplies are reduced by an identical amount. CCWD has additional water rights at Mallard Slough for a maximum diversion of Delta water of up to 26,700 AFY. Diversions from Mallard Slough are unreliable due to frequently poor water quality in the San Joaquin River at this point of diversion. Water quality conditions have restricted diversions from Mallard Slough to approximately 6,500 acre-feet per year (on average). In dry years, no water is available from this source.

d. Other

The City of Antioch and four industrial users hold water rights from the San Joaquin River. When these raw water customers of CCWD use San Joaquin River water, CVP supplies are reduced by a like amount. Actual diversions from the river are limited due to the poor water quality that often exists in the San Joaquin River. Antioch therefore relies on raw water deliveries from CCWD to meet remaining customer demand. These supplies, like the Mallard Slough supply, are variable because of poor water quality that often exists in the San Joaquin River. In dry years, little or no water is available from these sources.

2. Transfers

CCWD has signed an agreement with Eastern Contra Costa Irrigation District (ECCID) which allows CCWD to purchase up to 8,200 AFY for service in the common service area with ECCID and an additional 4,000 AFY of groundwater (by exchange) when CVP supplies are limited. Currently, supplies purchased from ECCID reduce use of CVP water by a like amount, but when build out is reached these purchases can augment CCWD's total supply.

3. Recycled Water

Recycled water is used to meet non-potable demands within CCWD's service area. This demand was approximately 1,000 AFY in 2000. In 2002, Delta Diablo Sanitation District's 12.5 mgd recycled water facility came online to serve recycled water to the newly constructed Delta Energy Center and Los Medanos Energy Center. Currently this facility produces approximately 9,000 AFY of recycled water for cooling water and boiler water at the power plants and landscape irrigation at parks and ballfields in the City of Pittsburg.

A breakdown of the year 2000 water supply by source is presented in Table B1-3 and Figure B1-3. It should be noted that the supplies shown do not necessarily reflect the total supply available, just the amount used in 2000.

Table B1-3
CCWD Water Use By Supply Source (2000)

Supply	***AFY***
Delta Supplies (1)	117,600
Water Transfers	6,600
Recycled water	1,000
Total	**125,200**

(1) Delta supplies consist primarily of Central Valley Project (CVP) water. When available, Los Vaqueros water rights and local Delta supplies reduce diversions of CVP by a like amount.

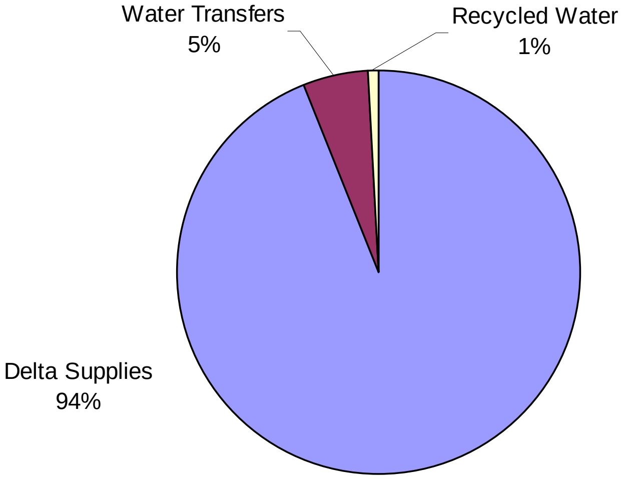

Figure B1-3
CCWD Water Use (2000) by Source

East Bay Municipal Utility District (EBMUD) Water Supplies

EBMUD's primary sources of water supply are the Mokelumne River, local supplies, recycled water and supplemental CVP water through Freeport.

1. Mokelumne River

This 577-sqaure mile protected watershed located on the west slope of the Sierra Nevada provides EBMUD with 95% of its water supply. EBMUD has water rights and facilities to divert up to 325 mgd from the Mokelumne River.

2. Local Supplies

Yield from local runoff is dependent upon hydrologic conditions and storage availability. Since the East Bay reservoirs regulate the EBMUD's Mokelumne supply and provide emergency standby storage, limited capacity is available to develop local yield. Local runoff can provide 15 to 25 mgd of supply during normal hydrologic years, but the supply is negligible during dry years.

3. Recycled Water

EBMUD customers currently use nearly 6 mgd of recycled water for landscape irrigation and industrial cooling.

4. Supplemental CVP Water

EBMUD also has a contract with the U.S. Bureau of Reclamation (USBR) for a supplemental supply of CVP water from American River. This contract allows for delivery of up to 165,000 acre-feet per year (AFY) over a three year drought. A project level EIR/EIS for the Freeport Regional Water Project was certified in April 2004, to allow for delivery of this water. Construction of facilities necessary to transfer the supply to EBMUD's supply system is scheduled to begin in 2006.

A breakdown of the year 2000 water supply by source is presented in Table B1-4 and Figure B1-4. It should be noted that the supplies shown in Table B1-4 do not necessarily reflect the total supply available, just the amount in the year 2000.

Table B1-4
EBMUD Water Use by Supply Source (2000)

Supply	*AFY*
Mokelumne River[1]	229,400
Local	12,100
Recycled Water	6,300
Total	**247,800**

[1] Mokelumne supply estimated as 95% of potable water deliveries for Year 2000.

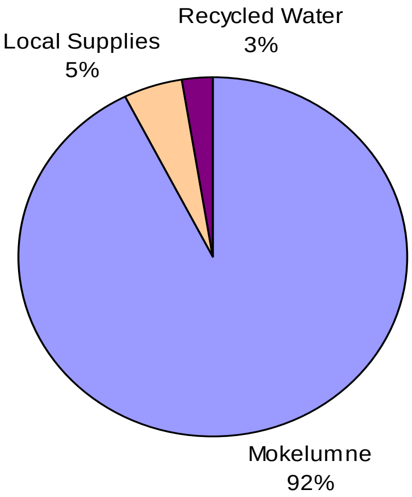

Figure B1-4

EBMUD Water Use (2000) by Source

San Francisco Public Utilities Commission (SFPUC) Water Supplies

The SFPUC's existing water supplies are from two primary sources: Tuolumne River and local watersheds in the East Bay and on the Peninsula.

1. Tuolumne River

Approximately 80 percent of SFPUC water supply is provided from runoff from the upper Tuolumne River watershed on the western slope of the central Sierra Nevada. Three major reservoirs collect runoff: Hetch Hetchy Reservoir, Lake Lloyd, and Lake Eleanor. Water is diverted from the Hetch Hetchy reservoir into a series of tunnels, aqueducts and pipelines that cross the San Joaquin Valley to facilities located in Alameda County (the Alameda System). The Alameda System includes conveyance facilities that connect the Hetch Hetchy System to facilities located in the San Francisco Peninsula (the Peninsula System), which connects to San Francisco's distribution system.

2. Local Bay Area Watersheds

Local watershed runoff, originating from the San Mateo Creek, Pilarcitos Creek and Alameda Creek Watersheds, continues to provide a significant portion of the water supply during normal years (20%), but represents a very small portion of deliveries during periods of drought. During the 1987-1992 drought, local runoff was only 6% of the total supply.

3. Other

A small portion of the SFPUC's retail water supply also comes from groundwater and recycled water. However, these supplies are negligible in comparison to the Tuolumne River and local Bay Area watersheds.

A breakdown of the year 2000 water supply by source is presented in Table B1-5 and Figure B1-5. It should be noted that the supplies shown in Table B1-5 do not necessarily reflect the total supply available, just the amount used in the year 2000.

Table B1-5
SFPUC Retail & Wholesale Water Use by Supply Source (2000) (1)

Supply	*AFY*
Tuolumne River(2)	239,400
Local	52,600
Total	**292,000**
Retail Total	**96,000**
Wholesale Total	**196,000**

Notes:

(1) Tuolumne River supply estimated based on current demand.

(2) The SFPUC provides water to both retail and wholesale water customers. The SFPUC's retail water customers include the residents, services and institutions within the corporate boundaries of the City and County of San Francisco. Retail water service is also provided to a number of users in the Bay Area and Sierra Nevada foothills including the U.S. Navy, Town of Sunol, San Francisco International Airport, and Lawrence Livermore Laboratory. The SFPUC wholesale customers include 29 cities, water districts and other agencies that are represented by BAWSCA. Wholesale customers include ACWD and entities within Santa Clara County who are also in Santa Clara Valley Water District. These uses are tabulated separately under those agency supply totals.

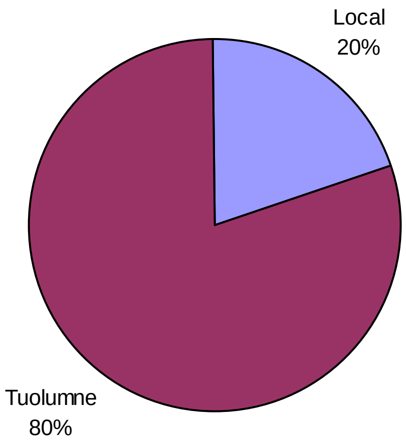

Figure B1-5
SFPUC Water Use (2000) by Source

Santa Clara Valley Water District (SCVWD) Water Supplies

The primary sources of Santa Clara County's water supply include local supplies, the Central Valley and State Water Projects, and SFPUC.

1. Local Supplies (runoff, groundwater)

The local water supply consists of runoff that is diverted into the District's 10 reservoirs or percolates into the ground to recharge the groundwater basin. The average yearly flow that can be captured and diverted is about 101,000 AFY. An average of 99,000 AF of natural recharge into the groundwater basin is also available.

2. Delta Supplies (CVP, SWP)

SCVWD has contracts with CVP and the SWP for deliveries of imported water. The amount of imported water actually delivered to the District in any given year is dependent upon: (1) hydrologic conditions; (2) requests by other SWP & CVP contractors; (3) SWP & CVP facility capacity; and (4) environmental/regulatory requirements. The SWP contract is for 100,000 AFY, but the average delivery is 60,000 AFY. The CVP contract is for 152,000 AFY, but the average delivery is 85,000 AFY**.**

3. SFPUC Supply

Several communities within Santa Clara County contract directly with SFPUC for imported water. The annual deliveries of SFPUC supply average about 60,000 AFY. Although the District does not control or administer these deliveries, SFPUC supplies reduce demands on District-supplied water.

4. Other Recycled Water

To expand water recycling within Santa Clara County, SCVWD has entered into partnerships with recycled water producers in Santa Clara County: the South Bay Water Recycling Program operating out of the San Jose/Santa Clara Water Pollution Control (WPCP), the Sunnyvale WPCP, and the South County Regional Wastewater Authority. SCVWD is pursuing greater involvement with the remaining producer, the Palo Alto Regional Water Quality Control Plant.

A breakdown of the year 2000 water supply by source is presented in Table B1-6 and Figure B1-6. It should be noted that the values shown in Table B1-6 do not necessarily reflect the total supply available, just the amount used by supply source in 2000.

Table B1-6
SCVWD Supplies (2000)

Supply	***AFY***
Groundwater	163,900
Treated Water	129,700
Surface Water	5,700
Recycled Water	900
Non-District(1)	83,100
Total	**383,300**

(1) Non-district supplies include SFPUC, San Jose Water Co. and others.

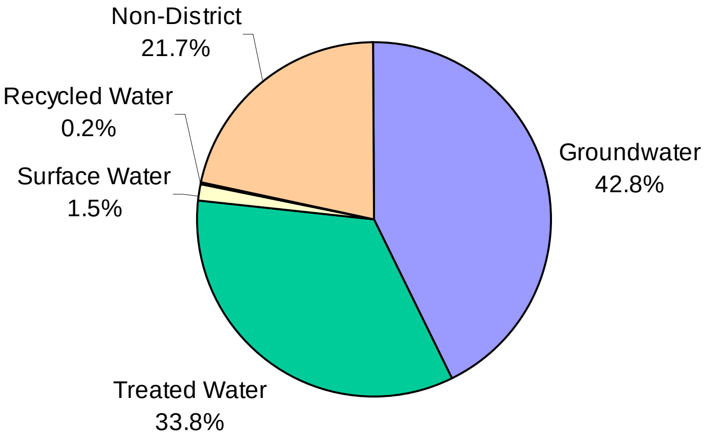

Figure B1-6
SCVWD Water Supply By Source (2000)

Zone 7 Water Agency (Zone 7) Water Supplies

Zone 7's existing water supplies include the State Water Project, local supplies, and other supplies. These water supplies are used to meet M&I water demands as well as the demands of agriculture, sand and gravel mining, and miscellaneous private domestic uses.

1. State Water Project

Including recent water transfers, Zone 7 currently has a maximum annual SWP allocation amount of 80,000 AF. The amount of SWP water actually delivered to Zone 7 in any given year is dependent upon: (1) hydrologic conditions; (2) requests by other SWP contractors; (3) SWP facility capacity; and (4) environmental/regulatory requirements.

2. Local Supplies (e.g., Groundwater, Del Valle Watershed)

Zone 7's local water supplies include the underlying aquifer known as the Main Basin, and runoff flows from the Arroyo Del Valle watershed. The sustainable yield of the Main Basin (i.e., the average annual quantity of water that can be extracted from the basin which will be replaced by natural recharge) is estimated to be 13,400 AFY, or roughly 6% of the basin's total storage capacity. Zone 7 also has rights to divert water from the Arroyo Del Valle watershed. This supply is approximately 9,300 acre-feet per year (AFY).

3. Other

In 1994, Zone 7 negotiated a short-term water transfer demonstration project with the Byron Bethany Irrigation District (BBID) for a minimum supplemental supply of 2,000 AFY. In 1998, this short-term transfer was converted into a long-term, 15-year agreement for up to 5,000 AFY. For planning purposes, Zone 7 assumes a conservative estimate of 2,000 AFY as the sustainable yield for this water supply.

A breakdown of the typical water supply available from each source is presented in Table B1-7 and Figure B1-7.

Table B1-7
Zone 7 Water Use by Supply Source (2000)

Supply	***AFY***
State Water Project	32,100
Local Supplies	26,200
Transfers	2000
Recycled Water	500
Total	**60,800**

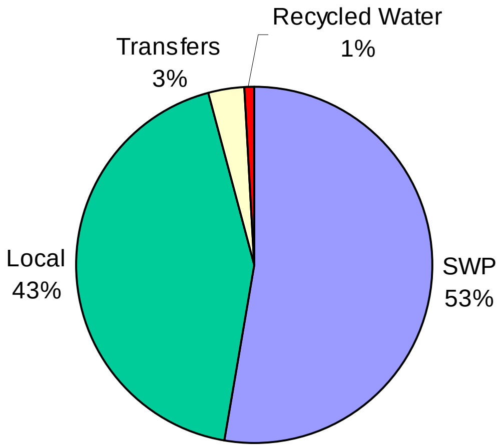

Figure B1-7
Zone 7 Water Supply By Source (2000)

Breakdown of Water Supplies for the Study Area

A breakdown of the different water supplies used within the study area is presented in Table B1-8 and Figure B1-8. This breakdown reflects normal hydrologic year conditions and is based on existing demands. To avoid misrepresentation and overlap, supplies provided by SFPUC to wholesale customers (BAWSCA, ACWD, SCVWD) are represented in Tuolumne supplies and are therefore not represented in the BAWSCA, ACWD, SCVWD supplies.

Table B1-8
Breakdown of Water Use by Supply for the Study Area
(2000) (1)

Supply	***AFY***
State Water Project	120,100
Central Valley Project	185,000
Tuolumne	239,400
Mokelumne	229,900
Local Supplies	249,300
Other	30,770
Total	**1,054,470**

(1) Includes composite data from Calendar Year 200.

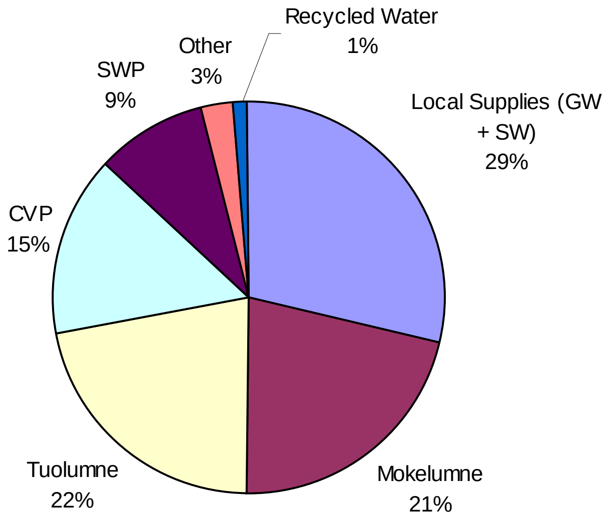

Figure B1-8
Breakdown of Water Use by Source for the Study Area (2000)

Water Supply Availability

The following sections provide participating agency's water supply availability under average and dry (single year, multiple-year) hydrologic conditions.

The normal and dry year supply projections were provided by individual agency staff and/or Urban Water Management Plans, and vary from the supply data presented earlier. It should also be noted that this analysis does not take into account any water supply projects that are planned to be developed after 2000 as part of each agencies Integrated Water Management Plan.

As stated previously, supply shortfalls are not included as part of this analysis. For supply shortfall information, please refer to agency-specific water resource documentation, such as Urban Water Management Plans, Integrated Water Resources Plans, etc.

ACWD – Water Supply

Table B1-9 provides ACWD's water supply availability under normal and dry (single year, multiple-year) hydrologic conditions. The Normal Year data is based on the median net water supply availability from existing water sources projected to be available to ACWD under 1922 through 1992 hydrologic conditions. The normal year data does not include "dry year" water supplies available to ACWD through temporary mining of the local groundwater basin or the use of water banked through the Semitropic groundwater banking program. As the availability of ACWD's various supply sources fluctuate on differing time scales, no specific calendar year is assigned to this median, "normal" value. Single Dry Year data is based on projected supply availability under 1977 drought conditions, and Multiple Dry Year data is based on the projected supply availability under the 1988-1990 drought conditions and reflects variable usage of banked groundwater in Semitropic and temporary mining of the local groundwater basin.

Table B1-9
ACWD Water Supply Availability

Supply vs. Demand	***Water Supply Conditions (AF)***				
	Normal Year	***Single Dry Year***	***Multiple Dry Years***		
			Year 1	***Year 2***	***Year 3***
Existing Supply:	**76,400**	**59,100**	**68,500**	**84,100**	**72,400**

Notes:

1. Normal Year Supply defined as median of total annual supply of all ACWD water sources, from 70 yr of local hydrology, SWP Table A values and contractual amount of SFPUC/Tuoloumne system.
2. Dry Year supplies include temporary mining of local groundwater and maximum utilization of banked groundwater in Semitropic. Normal Year supplies do not include mining of local groundwater or use of banked groundwater.
3. Existing supplies are based on information from ACWD's Urban Water Management Plan and/or input from ACWD staff, and do not reflect the 2000 supply information presented in earlier sections of this technical memorandum.
4. Existing supplies include (a) Phase 1 (5 mgd) of ACWD's brackish groundwater desalination facility which is planned to be operational in 2003, and (b) 150,000 AF of storage capacity at Semitropic Groundwater Banking Program.

BAWSCA – Water Supply

The collective water supply availability under varying hydrologic conditions for the BAWSCA agencies is not available from BAWSCA at this time. However, because roughly 95 percent of BAWSCA's members demand is supplied by ACWD, SCVWD, and SFPUC, the majority of BAWSCA's supply and demand information is included in the supply availability discussions for SFPUC, ACWD, and SCVWD.

CCWD – Water Supply

Table B1-10 provides CCWD's water supply availability under average and dry (single year, multiple-year) hydrologic conditions.

Table B1-10
CCWD Water Supply Availability

Supply vs. Demand	*Water Supply Conditions (AF)*				
	Normal Year	*Single Dry Year*	*Multiple Dry Years*		
			Year 1	*Year 2*	*Year 3*
Existing Supply:	229,000	160,000	160,000	138,000	124,000

Notes:
1. Supply data based on CCWD Urban Water Management Plan (2000) and/or input from CCWD staff and do not reflect the 2000 supply information presented earlier in this technical memorandum.

EBMUD – Water Supply

Table B1-11 presents EBMUD's existing water supply availability under average and dry (single year, multiple-year) hydrologic conditions. EBMUD has a CVP contract for up to 165,000 AF over three consecutive dry years. An EIR/EIS is currently under preparation for a supplemental water supply project located at Freeport on the Sacramento River. The Freeport project is expected to allow EBMUD to limit system-wide dry year rationing to 25%. Additional water supply projects are under evaluation to further reduce the expected frequency and severity of rationing.

Table B1-11
EBMUD Water Supply Availability

Demand Year	*Water Supply Conditions (AF)*				
	Normal Year	*Single Dry Year*	*Multiple Dry Years*		
			Year 1	*Year 2*	*Year 3*
Existing Supply:	242,000 (216 MGD)	224,000 (200 MGD)	224,000 (200 MGD)	181,000 (162 MGD)	140,000 (125 MGD)

Notes:
1. Existing supply data is based on information in the EBMUD Urban Water Management Plan (2000) and does not reflect the 2000 supply information provided earlier in this technical memorandum.

SFPUC – Water Supply

Table B1-12 provides a snap-shot of the SFPUC's water supply availability for both retail and wholesale customers under average and dry (single year, multiple-year) hydrologic conditions.

Table B1-12
SFPUC Water Supply Availability

Demand Year	***Water Supply Conditions (AF)***				
	Normal Year	***Single Dry Year***	***Multiple Dry Years***		
			Year 1	***Year 2***	***Year 3***
Existing Supply:	292,000	263,000	263,000	234,000	234,000

Notes:

1. Existing supply data is based on the SFPUC Urban Water Management Plan (2000) and does not necessarily reflect the 2000 water supply information provided earlier in this report.

SCVWD – Water Supply

Table B1-13 provides a comparison of SCVWD's water supply availability under average and dry (single year, multiple-year) hydrologic conditions. The Normal Year data is based on the average supply available over the historical record (1922 to 1990), given currently existing facilities and institutional arrangements. Single Dry Year data is based on projected supply availability under 1977 drought conditions, and Multiple Dry Year data is based on the projected supply availability under the 1987-1989 drought conditions.

Table B1-13
SCVWD Water Supply Availability

Demand Year	***Water Supply Conditions (AF)***				
	Normal Year	***Single Dry Year***	***Multiple Dry Years***		
			Year 1	***Year 2***	***Year 3***
Existing Supply:	440,800	158,700	378,000	321,000	427,000

Notes:

1. Existing supply data for normal and single dry years is based on information in the SCVWD Draft Integrated Water Resources Planning Study (2003).
2. Existing supply data for multiple dry years is based on information in the SCVWD Urban Water Management Plan (April 2001) and does not reflect 2000 supply information presented earlier in this technical memorandum nor SCVWD's latest planning data.

Zone 7 – Water Supply

Table B1-14 provides a comparison of Zone 7's water supply availability under average and dry (single year, multiple-year) hydrologic conditions.

Table B1-14
Zone 7 Water Supply Availability

Demand Year	***Water Supply Conditions (AF)***				
	Normal Year	***Single Dry Year***	***Multiple Dry Years***		
			Year 1	***Year 2***	***Year 3***
Existing Supply:	**84,100**	**84,100**	**84,100**	**84,100**	**84,100**

Notes:

1. Existing supply data is based on the Zone 7 Urban Water Management Plan and/or input from Zone 7 staff and does not reflect the 2000 use information presented earlier in this technical memorandum.

Water Supply for the Study Area

Table B1-15 provides the study area's water supply availability under average and dry (single year, multiple-year) hydrologic conditions. This table was created by aggregating the data from the individual agencies and subtracting out any overlap in data between SFPUC, ACWD and SCVWD.

Table B1-15
Water Supply Availability for the Study Area

Demand Year	***Water Supply Conditions (AF)***				
	Normal Year	***Single Dry Year***	***Multiple Dry Years***		
			Year 1	***Year 2***	***Year 3***
Existing Supply:	1,297,900	915,400	1,093,800	978,400	1,017,700

Notes:

1. Existing Supply data for given hydrologic year was determined from each agency's Urban Water Management Plan. Supply overlap between SFPUC, ACWD and SCVWD was subtracted out from the total.

List of Acronyms

ACWD	Alameda County Water District
AF	Acre-feet
AFY	Acre-feet per year
AG	Agricultural
BARWRP	Bay Area Regional Water Recycling Program
BAWAC	Bay Area Water Agencies Coalition
BAWSCA	Bay Area Water Supply and Conservation Agency
CCCSD	Contra Costa County Sanitation District
CCWD	Contra Costa Water District
CVP	Central Valley Project
EBMUD	East Bay Municipal Utility District
ECCID	East Contra Costa Irrigation District
JPA	Joint Powers Authority
MGD	Million gallons per day
SBSA	South Bayside System Authority
SBWR	South Bay Water Recycling
SCVWD	Santa Clara Valley Water District
SFPUC	San Francisco Public Utilities Commission
SWP	State Water Project
USBR	U.S Bureau of Reclamation
USD	Union Sanitary District
Zone 7	Zone 7 Water Agency

B2. Water Demand Projections

Appendix B2
Water Demand Projections

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Appendix B2
Water Demand Projections

The purpose of this technical memorandum is to present water demand projections for the agencies participating in the Bay Area Water Quality and Water Supply Reliability Program (BAWQ&WSRP) based on current baseline planning scenarios. Participating agencies include: Alameda County Water District (ACWD); Bay Area Water Supply and Conservation Agency (BAWSCA); Contra Costa Water District (CCWD); East Bay Municipal Utility District (EBMUD); San Francisco Public Utilities Commission (SFPUC); Santa Clara Valley Water District (SCVWD); and Zone 7 Water Agency (Zone 7).

Summary

The population and demand projections for the study area are provided in Table B2-1. Projections for ACWD, CCWD, EBMUD, and Zone 7 reflect projected future demands in these service areas. BAWSCA demand projections include all BAWSCA members (SFPUC wholesale customers) with the exception of ACWD and BAWSCA members located within Santa Clara County. SFPUC demand projections include all SFPUC retail customers. SCVWD projections include demands from SCVWD retail agencies as well as shared SFPUC wholesale customers located within Santa Clara County (Milpitas, Mountain View, No. San Jose, Santa Clara, Palo Alto, Purissima Hills, Stanford and Sunnyvale). Study Area Total demands reflect the projected demands generated throughout the Study area. To avoid double-counting customers, overlaps in data were addressed using the same methodology outlined in the BAWAC "Advancements in Water Conservation" Executive Summary. As shown in this table, population and Municipal and Industrial (M&I) water use are projected to increase by 15.9% and 15.4%, respectively, by 2020. Per capita water use is not expected to stay approximately the same.

Background

The development of demand projections for the study area was based on data collected as part of the Bay Area Water Agencies Coalition (BAWAC) "Advancements in Water Conservation" project and "Innovative Water Management Elements" project. Information on future demand projections was taken from Urban Water Management Plans or similar sources, as well as the *SFPUC Wholesale Customer Water Conservation Potential Technical Report* and *City and County of San Francisco Retail Water Demands and Conservation Potential*, and updated by water agency staff as necessary.

Results

The following sections provide details on assumptions used to develop the demand projections for each water agency and the study area as a whole.

Table B2-1
Study Area Projections

Year	*Baseline Projections*							
	ACWD	*BAWSCA (w/o overlap)* [1]	*CCWD*[2]	*EBMUD*	*SFPUC (retail)* [3]	*SCVWD* [4]	*Zone 7*[5]	*Study Area Total* [6]
Population Projections								
2000	312,800	846,300	431,700	1,270,000	757,000	1,682,600	167,000	5,467,400
2005	320,600	870,300	468,400	1,340,000	772,500	1,788,300	198,300	5,758,400
2010	328,400	893,900	507,100	1,370,000	788,000	1,879,700	225,000	5,992,100
2015	336,200	916,400	530,200	1,390,000	803,500	1,949,500	246,900	6,172,700
2020	344,000	936,500	553,300	1,420,000	819,000	2,007,500	255,400	6,335,700
% Change [9]	**9.97%**	**10.66%**	**28.17%**	**11.81%**	**8.19%**	**19.31%**	**52.93%**	**15.88%**
Overall M&I Water Use (AFY) [7]								
2000	56,100	129,200	157,400	241,500	100,900	347,300	42,000	1,074,400
2005	55,800	137,300	175,000	245,300	99,600	369,900	50,700	1,133,600
2010	58,900	141,800	192,700	253,100	99,100	379,100	59,400	1,184,100
2015	60,600	145,000	199,900	255,400	99,000	388,300	65,800	1,214,000
2020	62,200	149,500	207,100	256,500	99,200	397,000	67,800	1,239,300
% Change [9]	**10.87%**	**15.71%**	**31.58%**	**6.21%**	**-1.68%**	**14.31%**	**61.43%**	**15.35%**
Overall Per Capita M&I Water Use (gpcd)[8]								
2000	160	136	325	170	119	184	225	175
2005	155	141	334	163	115	185	228	176
2010	160	142	339	165	112	180	236	176
2015	161	141	337	164	110	178	238	176
2020	161	143	334	161	108	177	237	175
% Change [9]	**1%**	**5%**	**3%**	**-5%**	**-9%**	**-4%**	**6%**	**0%**

Notes:

[1] BAWSCA (w/o overlap) data excludes ACWD and BAWSCA customers in Santa Clara County (Milpitas, Mountain View, No. San Jose, Santa Clara, Palo Alto, Purissima Hills, Stanford and Sunnyvale). BAWSCA 2000 data from Bay Area Water Users Association Annual Survey FY2001-2002. Other data taken from *SFPUC Wholesale Customer Water Conservation potential Technical Report, 2004.*

[2] CCWD per capita water use includes major industrial use which accounts for approximately one-third of CCWD's overall water use.

[3] SFPUC (retail) data includes SFPUC retail customers only. Note that SFPUC retail population and demand projections are based on household population and employment figures not total population and employment. SFPUC data from *City and County of San Francisco Retail Water Demands and Conservation Potential, 2004.*

[4] SCVWD data includes BAWSCA members that receive water from SFPUC and SCVWD (Milpitas, Mountain View, No. San Jose, Santa Clara, Palo Alto, Purissima Hills, Stanford and Sunnyvale).

[5] Zone 7 projections updated per April 2004 Sustainable Water Supply Report.

[6] Study Area Totals were calculated as the sum of ACWD, BAWSCA (without overlap), CCWD, EBMUD, SFPUC (retail), and SCVWD.

[7] Values represent municipal and industrial (M&I) demand only.

[8] Overall per capita water use is calculated as "Overall Water Use" divided by "Population".

[9] % Change reflects the projected increase in each quantity between 2000 and 2020.

Alameda County Water District (ACWD) Demand Projections

Table B2-2 presents the population and demand projections for ACWD. As noted in this table, ACWD is projecting a 10% increase in population and a corresponding 8.5% increase in total water use by 2020.

Table B2-2
ACWD Projections

Year	***Population (1)***	***Water Use (AFY) (2)***			***M&I Per Capita Water Use (gpcd) (4)***
		Distribution	***Groundwater (3)***	***Total***	
2000	312,800	56,100	15,300	71,400	160
2005	320,600	55,800	15,300	71,100	155
2010	328,400	58,900	15,300	74,200	160
2015	336,200	60,600	15,300	75,900	161
2020	344,000	62,200	15,300	77,500	161
% Change	**10.0%**	**10.9%**	**0.0%**	**8.5%**	**1%**

Notes:

(1) 2000 population taken from ABAG Projections 2003. 2020 population from ACWD staff based on previous ABAG projections. 2005-2015 values estimated through interpolation.

(2) 2000 Water Use from ACWD Staff. Projected Water Use values based on "Middle Demand" scenario from ACWD's *Urban Water Management Plan 2001-2005.*

(3) Groundwater column reflects demand for nonpotable groundwater recharge only.

(4) Per capita water use reflects Municipal & Industrial (M&I) demand only (e.g., the Distribution system demand), and does not include the 15,300 AF of non-potable demands.

Bay Area Water Supply and Conservation Agency (BAWSCA) Demand Projections

Table B2-3 presents the population and demand projections for BAWSCA. The "total" data is inclusive of all BAWSCA members (SFPUC wholesale customers), including ACWD and members within Santa Clara County. The "w/o Overlap" data reflects the BAWSCA demands excluding any overlap with ACWD and SFPUC wholesale customers in Santa Clara County.

As noted in Table B2-3, BAWSCA is projecting a 13% increase in total population and a corresponding 17% increase in total water use by 2020.

Table B2-3
BAWSCA Projections

Year	Population		Water Use (AF)		Per Capita Water Use (gpcd)	
	Total [(1)]	w/o Overlap [(2)]	Total [(3)]	w/o Overlap [(2)]	Total	w/o Overlap
2000	1,634,268	846,300	295,900	129,200	162	136
2005	1,688,200	870,300	315,600	137,300	167	141
2010	1,741,100	893,900	326,700	141,800	168	142
2015	1,792,600	916,400	335,300	145,000	167	141
2020	1,841,000	936,500	344,700	149,500	167	143
Total Change (%)	**12.6%**	**10.7%**	**16.5%**	**15.7%**	**3.4%**	**4.6%**

Notes:

(1) BAWSCA Year 2000 data from Bay Area Water Users Association Annual Survey FY2001-2002. Other data from *SFPUC Wholesale Customer Water Conservation potential Technical Report, 2004.*

(2) Data referred to as "w/o Overlap" excludes ACWD and BAWSCA member agencies in Santa Clara County (Milpitas, Mountain View, No. San Jose, Santa Clara, Palo Alto, Purissima Hills, Stanford and Sunnyvale).

(3) Total Year 2000 Water Use data from BAWUA *Annual Survey Results, FY 2001/02.* 2005, 2010, 2020 values from updated water use data and projections provided by BAWSCA in September, 2004.

Contra Costa Water District (CCWD) Demand Projections

Table B2-4 presents the population and demand projections for CCWD. As noted in this table, CCWD is projecting a 28.2% increase in population and a corresponding 31.6% increase in water use by 2020.

Table B2-4
CCWD Projections

Year	***Population [1]***	***Water Use (AFY) [2]***	***Per Capita Water Use [3] (gpcd)***
2000	431,700	157,400	326
2005	468,400	175,050	334
2010	507,100	192,700	339
2015	530,200	199,900	337
2020	553,300	207,100	334
Total Change (%)	**28.2%**	**31.6%**	**2.7%**

Notes:

(1) Population from CCWD *Urban Water Management Plan,* 2000. 2005-2015 values estimated via interpolation.

(2) Projected water use values from CCWD *Future Water Supply Study 2002 Update.* 2005-2015 values estimated via interpolation. Year 2000 demand includes hard conservation and reserved industrial capacity but does not include reductions due to soft conservation (which incorporates drought rebound). If existing soft conservation is maintained and the industrial reserved capacity is not utilized in the future, year 2020 demands may be smaller by up to 30,000 AF.

(3) Per Capita Use includes major industrial demand which accounts for one-third of CCWD's total water use.

East Bay Municipal Utility District (EBMUD) Demand Projections

Table B2-5 presents population and demand projections for EBMUD. As noted in this table, EBMUD is projecting a 12% increase in population and a 6.2% increase in total water use by 2020.

Table B2-5
EBMUD Projections

Year	*Population* [(1)]	*Water Use (AFY)* [(2)]	*Per Capita Water Use (gpcd)*
2000	1,270,000	241,500	170
2005	1,340,000	245,300	163
2010	1,370,000	253,100	165
2015	1,390,000	255,400	164
2020	1,420,000	256,500	161
Total Change (%)	**11.8%**	**6.2%**	**-5.0%**

Notes:

(1) Population values from EBMUD *Urban Water Management Plan 2000.*

(2) Water Use values from EBMUD *Urban Water Management Plan 2000.*

San Francisco Public Utilities Commission (SFPUC) Demand Projections

Table B2-6 presents population and demand projections for SFPUC's retail and wholesale customers. The SFPUC's retail water customers include the residents, services and institutions within the corporate boundaries of the City and County of San Francisco. Retail water service is also provided to a number of users in the Bay Area and Sierra Nevada foothills including the U.S. Navy, Town of Sunol, San Francisco International Airport, and Lawrence Livermore Laboratory. SFPUC's wholesale customers include the 28 cities and agencies represented by BAWSCA.

As shown in this table, SFPUC is projecting an 11% increase in total population and a 12% increase in total water use by 2020.

Table B2-6
SFPUC Projections

Year	***Population***			***Water Use (AFY)***			***M&I Per Capita Water Use (gpcd)[3]***
	Retail [1]	***Wholesale[2]***	***Total***	***Retail***	***Wholesale***	***Total***	
2000	757,000	1,634,268	2,391,268	100,900	295,900	396,800	148
2005	772,500	1,688,200	2,460,700	99,600	315,600	415,200	151
2010	788,000	1,741,100	2,529,100	99,100	326,700	425,800	150
2015	803,500	1,792,600	2,596,100	99,000	335,300	434,300	149
2020	819,000	1,841,000	2,660,000	99,200	344,700	443,900	149
Total Change (%)	**8.2%**	**12.6%**	**11.2%**	**-1.7%**	**16.5%**	**11.9%**	**0.6%**

Notes:

(1) Retail population and water use values from *City and County of San Francisco Retail Water Demands and Conservation Potential.*

(2) Wholesale Year 2000 data from Bay Area Water Users Association Annual Survey FY2001-2002. Other data from *SFPUC Wholesale Customer Water Conservation potential Technical Report, 2004.*

(3) Per capita water use includes both retail and wholesale data.

Santa Clara Valley Water District (SCVWD) Demand Projections

Table B2-7 presents population and demand projections for SCVWD. As shown in this table, SCVWD is projecting a 19.6% increase in total population and a corresponding 10.9% increase in total water use by 2020.

Table B2-7
SCVWD Projections

Year	***Population (1)***	***Water Use (AFY) (2)***			***M&I Per Capita Water Use (gpcd) (3)***
	Total	***M&I***	***Ag***	***Total***	***Total***
2000	1,682,600	347,300	29,200	382,500	184
2005	1,788,300	369,900	34,000	403,900	185
2010	1,879,700	379,100	33,000	412,100	180
2015	1,949,500	388,300	31,000	419,300	178
2020	2,007,500	397,000	30,000	427,000	177
Total Change (%)	**19.6%**	**14.3%**	**2.7%**	**11.6%**	**-4.2%**

Notes:

(1) Population data from SCVWD Staff

(2) Water Use projections from SCVWD Draft Integrated Water Resources Planning Study 2003.

(3) Per capita water use reflects Municipal & Industrial (M&I) demand only and does not include the agricultural demands

Zone 7 Water Agency (Zone 7) Demand Projections

Table B2-8 presents population and demand projections for Zone 7. As shown in this table, Zone 7 is projecting a 68.3% increase in population and a corresponding 32.3% increase in total water use by 2020.

Table B2-8
Zone 7 Projections

Year	***Population[1]***	***Water Use (AFY)[2]***			***M&I Per Capita Water Use (gpcd)[3]***
		M&I	***Non-M&I***	***Total***	
2000	167,000	42,000	19,000	61,000	225
2005	198,300	50,700	10,200	60,900	228
2010	225,000	59,400	12,300	71,700	236
2015	246,900	65,800	12,600	78,400	238
2020	255,400	67,800	12,800	80,600	237
Total Change (%)	**68.3%**	**61.0%**	**-31.1%**	**32.3%**	**-4.4%**

Notes:

(1) 2000 Population from Zone 7 Staff. Population projections from Zone 7 UWMP, 2000

(2) 2000 Water Use from Andy Florendo, Zone 7 Water Agency. Water Use projections from Zone 7's *Annual Review of the Sustainable Water Supply, April 2004.*

(3) Per capita water use reflects Municipal & Industrial (M&I) demand only and does not include the agricultural, mining or other non-potable demands.

Study Area Demand Projections

Baseline projections for the study area are provided in Table B2-9. Projections for ACWD, CCWD, EBMUD, and Zone 7 reflect projected future demands in these service areas. BAWSCA (w/o Overlap) demand projections include all BAWSCA members (SFPUC wholesale customers) with the exception of ACWD and BAWSCA members (SFPUC wholesale customers) within Santa Clara County. SFPUC demand projections include all SFPUC retail customers. SCVWD projections include demands from SCVWD retail agencies as well as shared SFPUC wholesale customers within Santa Clara County. Study Area Total demands reflect the projected demands generated throughout the Study area. In order to avoid double-counting customers, overlaps in data were addressed using the same methodology outlined in the BAWAC "Advancements in Water Conservation" Executive Summary.

The water use values are for Municipal and Industrial (M&I) use only and exclude and agricultural or other non-potable demands.

As shown in this table, a 15.9% increase in population is projected for the study area by 2020, and a corresponding 15.4% increase in water use is projected over the same period, with per capita water usage remaining approximately constant.

Table B2-9
Study Area Projections

Year	*Baseline Projections*							
	ACWD	*BAWSCA (w/o overlap)* (1)	*CCWD*	*EBMUD*	*SFPUC (retail)* (2)	*SCVWD* (3)	*Zone 7*(4)	*Study Area Total* (5)
Population Projections								
2000	312,800	846,300	431,700	1,270,000	757,000	1,682,600	167,000	5,467,400
2005	320,600	870,300	468,400	1,340,000	772,500	1,788,300	198,300	5,758,400
2010	328,400	893,900	507,100	1,370,000	788,000	1,879,700	225,000	5,992,100
2015	336,200	916,400	530,200	1,390,000	803,500	1,949,500	246,900	6,172,700
2020	344,000	936,500	553,300	1,420,000	819,000	2,007,500	255,400	6,335,700
% Change (8)	**9.97%**	**10.66%**	**28.17%**	**11.81%**	**8.19%**	**19.31%**	**52.93%**	**15.88%**
Overall M&I Water Use (AFY) (6)								
2000	56,100	129,200	157,400	241,500	100,900	347,300	42,000	1,074,400
2005	55,800	137,300	175,000	245,300	99,600	369,900	50,700	1,133,600
2010	58,900	141,800	192,700	253,100	99,100	379,100	59,400	1,184,100
2015	60,600	145,000	199,900	255,400	99,000	388,300	65,800	1,214,000
2020	62,200	149,500	207,100	256,500	99,200	397,000	67,800	1,239,300
% Change (8)	**10.87%**	**15.71%**	**31.58%**	**6.21%**	**-1.68%**	**14.31%**	**61.43%**	**15.35%**
Overall Per Capita M&I Water Use (gpcd)(7)								
2000	160	136	325	170	119	184	225	175
2005	155	141	334	163	115	185	228	176
2010	160	142	339	165	112	180	236	176
2015	161	141	337	164	110	178	238	176
2020	161	143	334	161	108	177	237	175
% Change (8)	**1%**	**5%**	**3%**	**-5%**	**-9%**	**-4%**	**6%**	**0%**

Notes:

(1) BAWSCA (w/o overlap) data excludes ACWD and BAWSCA customers in Santa Clara County (Milpitas, Mountain View, No. San Jose, Santa Clara, Palo Alto, Purissima Hills, Stanford and Sunnyvale). BAWSCA 2000 data from Bay Area Water Users Association Annual Survey FY2001-2002. Other data taken from *SFPUC Wholesale Customer Water Conservation potential Technical Report, 2004.*

(2) SFPUC (retail) data includes SFPUC retail customers only. Note that SFPUC retail population and demand projections are based on household population and employment figures not total population and employment. SFPUC data from *City and County of San Francisco Retail Water Demands and Conservation Potential, 2004.*

(3) SCVWD data includes BAWSCA members that receive water from SFPUC and SCVWD (Milpitas, Mountain View, No. San Jose, Santa Clara, Palo Alto, Purissima Hills, Stanford and Sunnyvale).

(4) Zone 7 projections updated per April 2004 Sustainable Water Supply Report.

(5) Study Area Totals were calculated as the sum of ACWD, BAWSCA (without overlap), CCWD, EBMUD, SFPUC (retail), and SCVWD.

(6) Values represent municipal and industrial (M&I) demand only.

(7) Overall per capita water use is calculated as “Overall Water Use” divided by “Population”.

(8) % Change reflects the projected increase in each quantity between 2000 and 2020.

List of Acronyms

ABAG	Association of Bay Area Governments
ACWD	Alameda County Water District
AFY	Acre Feet per Year
BAWSCA	Bay Area Water Supply and Conservation Agency (formerly BAWUA)
BAWUA	Bay Area Water Users Association
CCWD	Contra Costa Water District
EBMUD	East Bay Municipal Utility District
gpcd	Gallons per capita per day
M & I	Municipal and Industrial
SCVWD	Santa Clara Valley Water District
SFPUC	San Francisco Public Utilities Commission
Zone 7	Alameda County Flood Control and Water Conservation District - Zone 7

Appendix C

Agency Baseline Supplies and Water Quality

Appendix C
Agency Baseline Supplies and Water Quality

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Appendix C
Agency Baseline Supplies and Water Quality

1.0 Overview

During the Bay Area Regional Water Quality and Supply Reliability Program evaluation, the project team compiled water quality and supply data, with the goal of evaluating the effects of hydrology on water supply and water quality for the agencies. When concepts are analyzed, the primary objectives for which they are evaluated are their ability to improve supply reliability, and their potential impact on or benefit to water quality. Baseline information such as that presented in this memorandum provides the starting point, or baseline condition.

If, for example, a desalination concept is implemented which will produce water with a TDS of 150 mg/L, the potential effect of adding that supply source cannot be estimated without first looking to the water quality baseline as a point of reference. If the average TDS concentration for the agency supplies is 100 mg/L, this desalination facility may degrade water quality. If, however, the TDS for that agency increases to 200 mg/L in dry years and the desalination facility would be used primarily as a dry year source, then the desalination facility might actually improve water quality in dry years. If the desalinated water is blended with existing supplies before entering the distribution system, but only comprises 5 percent of the blended water, the water quality improvement may be so minimal as to be negligible. If the amount of desalinated water is 80 percent of the blended water, however, the water quality improvement may be significant. As the quantity of the individual water supply sources are increased or decreased, the blended water quality potentially changes enough to affect disinfection by-product production and/or treatment requirements. As a result, both water quality and supply baselines are necessary to gain a thorough understanding of how implementation of new concepts will impact both supply and water quality.

Future baseline estimates were established for three distinct hydrologic periods:

- Critical dry year (1977)
- Extended drought period (1987-1992)
- Average year (year varies depending on data source)

The future baselines are based on monthly flow and water quality data that are intended to represent the year 2020 projected supply and water quality conditions for each major source of supply during the three different hydrologic conditions. Each of the project concepts will be analyzed to determine the quantity of water contributed to agency supplies, as well as the quality of that supply. By combining the new supplies contributed by the project concepts with the established baseline supplies, it is possible to project the water supply and water quality conditions that would be experienced should that concept be implemented. The concepts will not be presented in the context of improvements over baseline data, nor will they be compared to one another based on their ability to achieve project objectives. The baseline will be used only to determine what the relative result of concept implementation is likely to be from both water supply and water quality standpoints.

2.0 Data Sources

Agencies receive imported supplies from the Sacramento-San Joaquin River Delta via State Water Project or Central Valley Project facilities or Sierra sources. This section provides an overview of information sources used to develop future 2020 supply and water quality baselines. Section 4.0 summarizes individual agency baselines in more detail.

- **CALFED Common Assumptions Studies.** For CALFED studies, the CalSim II water resources simulation model of the State Water Project/Central Valley Project system and Delta Simulation Model (DSM) II are being used to evaluate Delta operations, project supply yields, and associated water quality effects for existing and future operational scenarios. The CALFED Common Assumptions Workgroup has established the Common Assumptions simulation runs that are being used for various CALFED studies, so that individual studies use consistent analysis scenarios. This project is consistent with the Common Assumptions simulations runs, which are based on the Central Valley Project Operations Criteria and Plan (OCAP) Study 4, with South Bay Aqueduct operations as updated by the Expanded Los Vaqueros Studies team,[1] for agencies receiving State or Federal water from the Sacramento-San Joaquin Delta.

  DSM II modeling studies report Delta and SWP salinities using chloride. Bromide was calculated from simulated chloride concentrations using the relationship:

  - Br [mg/L]= 0.00341 * Cl- [mg/L] - 0.033 where chloride and TDS are in mg/L

---

[1] This simulation includes 2020 level of development and hydrology, Central Valley Improvement Act 3406(b)2 provisions, South Delta Improvements, Freeport Regional Water Project, and H.O. Banks Pumping Plant at 8,500 cfs capacity. The Expanded Los Vaqueros (ELV) study team used this run as a basis for Expanded Los Vaqueros operations, and included operations for the Environmental Water Account. SWP deliveries from the ELV studies were used to develop baselines for Zone 7 and SCVWD. ACWD provided baseline supply projections based on OCAP Study 4 for the BAWQ&SRP. These baseline supply projections could not be used by the ELV studies team because of differing simulation periods (ACWD estimates cover 1970 through 1992 historical hydrological periods while ELV studies is using a longer 1922 through 1992 simulation period), and the data could not easily be reconciled.

Total Dissolved Solids (TDS) was calculated from chloride using the following relationships:

- TDS [mg/L] = 1.828 * Cl^- [mg/L] +118.8 (seawater equation) and
- TDS [mg/L] = 4.08 * Cl^- [mg/L] +30.2 (agricultural drainage)

The maximum value of the two relationships used to estimate SWP TDS [2].

- **Agency Simulation Studies.** Individual agency simulation studies were used, where available. For example, EBMUD provided projected year 2020 Mokelumne Aqueduct drafts from Pardee Reservoir, as well as simulated Freeport Regional Water Project deliveries.
- **Historical Baselines.** Historical dry-year supply data were used where agencies do not anticipate significant changes in dry-year supply yields (e.g. SFPUC Hetch Hetchy supply). Where simulated water quality data were not available, historical water quality data were used.

---

[2] CALFED Los Vaqueros Expansion Studies Reservoir Water Quality Technical Memorandum, July, 2004.

3.0 Agency Baselines

3.1 Alameda County Water District (ACWD)

3.1.1 Water Supply Data and Baselines

This section provides a brief discussion of the water supply data that has been collected, as well as any historical anomalies that could lead to uncharacteristic data being included in the baseline.

Overview

Supplies

- San Francisco Public Utilities Commission (SFPUC) Supplies
- State Water Project (SWP) Supplies
- Local groundwater supplies - not included in this study

ACWD receives supplies from both the SFPUC regional system and the State Water Project. For the SFPUC system, both water supply and water quality changes are estimated as water is conveyed into the Bay Division Pipelines (BDPLs). For the SWP supply, water supply and water quality are estimated as based on the CALFED Common Assumptions simulated baseline.

Monthly water supply and consumption reports have been compiled for SFPUC dating from 1962 through 1998. These reports, prepared by SFPUC's Water Supply & Treatment Division, summarize monthly demands, supplies, and reservoir levels, and compare current month conditions with the past year. These reports were replaced with daily reports after 1998. In addition, the 2000-2001 and 2001-2002 BAWUA Annual Survey Results reports contain annual SFPUC and SCVWD purchase projections for the BAWSCA member agencies (SFPUC wholesale customers) for the years 2000 through 2020. The reports summarize historical and projected annual demands, supplies, and populations by agency. BAWSCA has also provided updated demand and population projections.

Monthly baseline SFPUC supply projections have been developed for ACWD using historical SFPUC delivery data in conjunction with the BAWUA Annual Survey report projected delivery percentages and ACWD's projected monthly purchase distributions. Historical ACWD supplies were compiled from historical regional system deliveries contained in the SFPUC reports. The BAWUA annual reports project that, in the year 2020, ACWD demand for SFPUC supplies will account for approximately 7 percent of total SFPUC wholesale customer demand. Historical annual SFPUC wholesale deliveries were compiled for the hydrologic periods being considered[3], and ACWD's annual allocations were assumed to be seven percent of this total purchase amount. The conceivable future monthly purchase distribution provided by ACWD was then applied to this annual number to compile monthly SFPUC purchase estimates for ACWD.

The ACWD supply baseline for SWP deliveries was developed using simulated data developed by ACWD. These deliveries are based on the CALFED Common Assumptions working groups OCAP Study 4. [4]

This flow data is reviewed below for the three hydrologic periods to be used, and is summarized in Table C-1.

---

[3] Note: 1988, 1989, and 1990 historical annual SFPUC wholesale customer purchases were subject to cutbacks of less than 20 percent. For these years, the historical SFPUC wholesale customer allocations were altered as outlined in the Interim Water Shortage Allocation Plan Among Suburban Purchasers, November 16, 2000.

[4] This simulation includes 2020 level of development and hydrology, Central Valley Improvement Act 3406(b) 2 provisions, South Delta Improvements, Freeport Regional Water Project, and H.O. Banks Pumping Plant at 8,500 cfs capacity. Although ACWD delivery information was developed for use by the Expanded Los Vaqueros (ELV) studies team, the ACWD delivery estimates are based on a shorter simulation period than being used in ELV studies and are not being used in the ELV analysis.

Table C-1
ACWD Water Supply Baselines (MGD)

Month	***SFPUC Supply***	***SWP Supply***	***Total Supply***	***Month***	***SFPUC Supply***	***SWP Supply***	***Total Supply***
Critical Dry Year				**Average Year (1)**			
Oct-76	12.7	24.0	36.7	Oct (Average Year)	22.6	37.1	59.7
Nov-76	6.0	22.0	28.0	Nov (Average Year)	6.3	37.1	43.5
Dec-76	2.2	22.0	27.4	Dec (Average Year)	2.2	36.0	38.2
Jan-77	3.7	16.0	20.8	Jan (Average Year)	3.7	33.1	36.8
Feb-77	4.3	16.0	20.3	Feb (Average Year)	4.5	30.7	35.2
Mar-77	4.5	16.0	20.5	Mar (Average Year)	5.0	33.4	38.4
Apr-77	5.4	16.0	21.4	Apr (Average Year)	7.6	38.7	46.3
May-77	4.9	17.4	22.3	May (Average Year)	20.7	41.0	61.7
Jun-77	5.9	23.2	29.1	Jun (Average Year)	23.8	41.8	65.5
Jul-77	6.2	24.0	30.2	Jul (Average Year)	24.6	43.3	67.9
Aug-77	6.0	24.0	30.0	Aug (Average Year)	24.6	43.3	67.9
Sep-77	5.2	0.0	5.2	Sep (Average Year)	19.5	41.8	61.3
WY Average	5.6	18.4	24.3	WY Average	13.7	38.1	51.9
WY Average (AFY)	6,250	20,590	27,250	WY Average (AFY)	15,400	42,700	58,100
Extended Dry Year							
Oct-1986	22.0	24.0	46.0	Oct-1989	16.0	25.0	41.0
Nov-1986	6.2	24.0	30.2	Nov-1989	4.5	22.0	26.5
Dec-1986	2.2	23.3	25.4	Dec-1989	1.6	22.0	23.6
Jan-1987	3.6	21.4	25.0	Jan-1990	2.6	16.0	18.6
Feb-1987	4.4	19.2	23.6	Feb-1990	3.2	16.0	19.2
Mar-1987	4.8	21.6	26.5	Mar-1990	3.5	20.8	24.3
Apr-1987	7.4	25.0	32.4	Apr-1990	5.4	22.4	27.8
May-1987	20.2	26.5	46.7	May-1990	14.7	27.0	41.7
Jun-1987	23.1	27.0	50.1	Jun-1990	16.9	27.5	44.4
Jul-1987	23.9	27.0	50.9	Jul-1990	17.4	25.0	42.4
Aug-1987	23.9	27.0	50.9	Aug-1990	17.4	25.0	42.4
Sep-1987	19.0	26.0	45.0	Sep-1990	13.9	24.5	38.4
Oct-1987	17.7	24.0	41.7	Oct-1990	13.2	22.0	35.2
Nov-1987	5.0	24.0	29.0	Nov-1990	3.7	21.0	24.7
Dec-1987	1.7	23.3	25.0	Dec-1990	1.3	17.0	18.3
Jan-1988	2.9	16.0	18.9	Jan-1991	2.2	20.0	22.2
Feb-1988	3.5	16.6	20.1	Feb-1991	2.6	20.0	22.6
Mar-1988	3.9	16.0	19.9	Mar-1991	2.9	21.8	24.7
Apr-1988	5.9	16.0	21.9	Apr-1991	4.4	25.0	29.4
May-1988	16.2	16.0	32.2	May-1991	12.1	29.0	41.1
Jun-1988	18.6	19.0	37.6	Jun-1991	13.9	29.0	42.9
Jul-1988	19.2	23.0	42.2	Jul-1991	14.4	28.0	42.4
Aug-1988	19.2	27.0	46.2	Aug-1991	14.4	26.0	40.4
Sep-1988	15.3	26.3	41.6	Sep-1991	11.4	24.0	35.4
Oct-1988	16.0	22.0	38.0	Oct-1991	14.4	24.0	38.4
Nov-1988	4.5	9.5	14.0	Nov-1991	4.0	14.2	18.3
Dec-1988	1.6	1.6	3.1	Dec-1991	1.4	0.3	1.8
Jan-1989	2.6	22.0	24.6	Jan-1992	2.4	22.0	24.4
Feb-1989	3.2	22.0	25.2	Feb-1992	2.9	22.8	25.7
Mar-1989	3.5	24.0	27.5	Mar-1992	3.2	24.0	27.2
Apr-1989	5.4	24.0	29.4	Apr-1992	4.8	25.0	29.8
May-1989	14.7	27.0	41.7	May-1992	13.2	29.0	42.2
Jun-1989	16.9	29.0	45.9	Jun-1992	15.2	29.0	44.2
Jul-1989	17.4	29.0	46.4	Jul-1992	15.7	29.0	44.7
Aug-1989	17.4	29.0	46.4	Aug-1992	15.7	29.0	44.7
Sep-1989	13.9	29.0	42.9	Sep-1992	12.4	29.0	41.4
Average					10.1	22.8	32.9
Average (AFY)					11,290	25,520	36,820

(1) Uses 1990 – 1994 to represent average hydrology for the SFPUC source and 1984 for the SWP supply.

Critical Dry Year Analysis (WY 1977)

Figure C-1 shows critical year imported supplies for ACWD, broken out into SFPUC and SWP supplies.

- Total critical year ACWD supply is projected to be 24 MGD (27,000 AFY), with 6 MGD (6,000 AFY) from SFPUC supplies and 18 MGD (21,000 AFY) from SWP supplies.

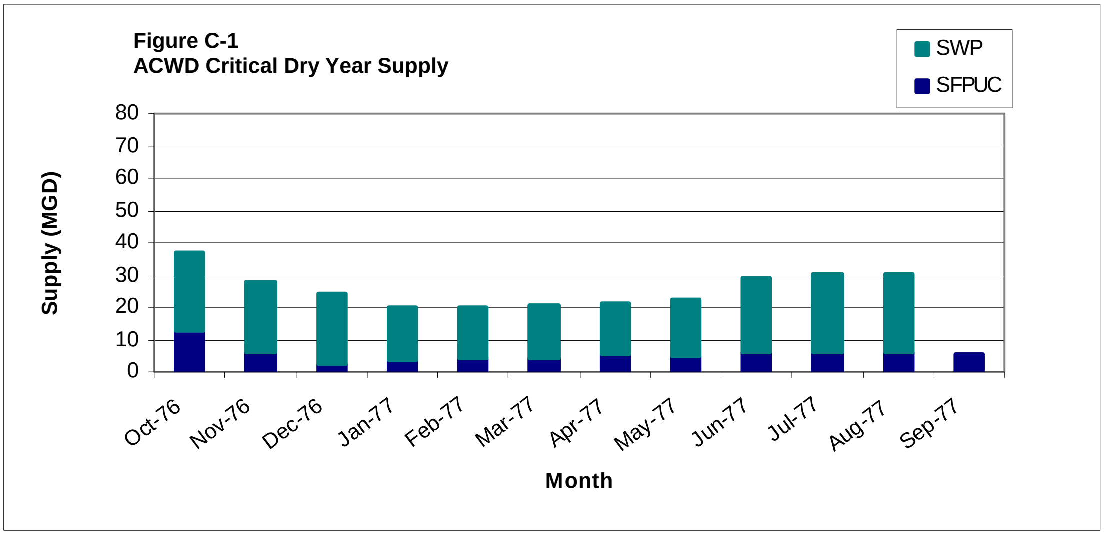


Figure C-1
ACWD Critical Dry Year Supply

Extended Dry Year Analysis (WY 1987 - 1992)

Figure C-2 shows drought year supplies.

- Average agency imported supplies are projected to be 33 MGD (37,000 AFY), with 10 MGD (11,000 AFY) from SFPUC supplies and 23 MGD (26,000 AFY) from SWP supplies.

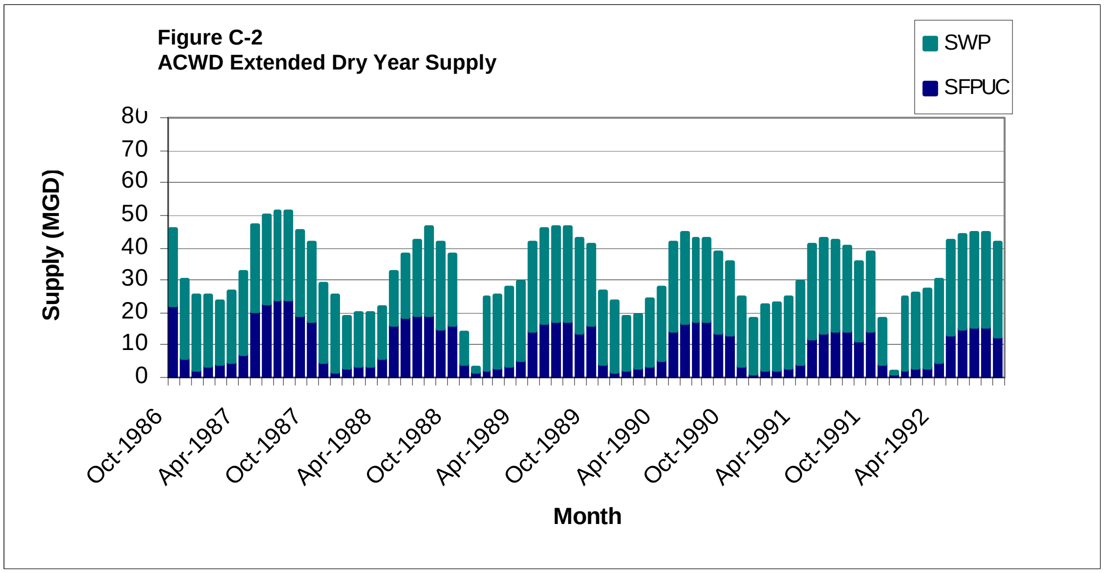


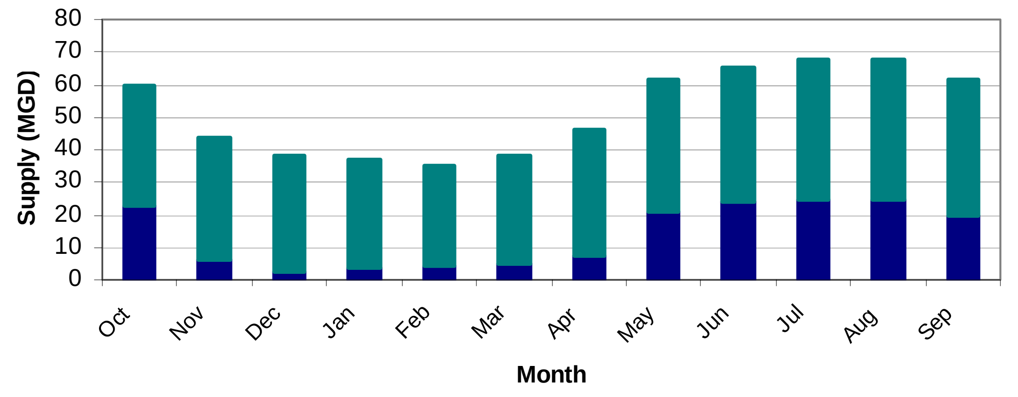
Figure C-2
ACWD Extended Dry Year Supply

Average Year Analysis (WY 1994-1998, 1984)

Figure C-3 shows average year supplies. For the SFPUC source, historical monthly average supplies for the 1994 through 1998 period were adjusted upward to meet projected average year demands met by SFPUC. For the SWP source, water year 1984 was used to represent average hydrology.

- Average agency imported supplies are projected to be 52 MGD (58,000 AFY), with 14 MGD (15,000 AFY) from SFPUC supplies and 38 MGD (43,000 AFY) from SWP supplies.

Figure C-3
ACWD Average Year Supply



3.1.2 Water Quality Data and Baselines

This section provides a brief discussion of the water quality data that has been collected, as well as methods implemented to fill in data gaps. In addition, any historical anomalies that could lead to uncharacteristic data being included in the baseline are identified.

Overview

ACWD water supply sources and facilities are described in Section 3.1.1[5]

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[5] While local groundwater is not included in this study, it should be noted that SFPUC supplies are blended with groundwater. Although SFPUC water quality data is included here, SFPUC supplies to ACWD are blended with local groundwater supplies before entering the treatment plants in ACWD system.

Water Quality Parameters

- **TOC** – monthly blended point concentrations have been compiled for each of the SFPUC and SWP supplies. This data will be used for quantitative water quality and treatment analysis.
- **TDS** – monthly blended point concentrations have been compiled for the SFPUC supply. Simulated SWP chloride data was converted to TDS. This data will be used for quantitative water quality and treatment analysis.
- **Bromide** - monthly blended point concentrations have been compiled for the SFPUC supply. Simulated SWP chloride data was converted to bromide. This data will be used for quantitative water quality and treatment analysis.
- **Temperature, pH** – data has been collected for the SFPUC and SWP supplies and will be used in a qualitative assessment. No formal baseline will be established for this data.

Available historical monthly TOC, TDS and bromide data were collected for the years 1977 and 1987-1999, for the SFPUC San Antonio Reservoir, Calaveras Reservoir, and Hetch Hetchy Aqueduct sources. Section 3.6 of this Technical Memorandum provides more detailed information regarding the SFPUC supplies. Simulated bromide and TDS were calculated from simulated chloride data for the Clifton Court Forebay.

Harvey O. Banks Pumping Plant dissolved organic carbon (DOC) data was collected from 1986 through 1997. This data was used as a surrogate for 1987 through 1992 extended dry year TOC data. In addition, Banks 1990 through 1997 DOC data was averaged by month to obtain monthly TOC concentrations for the average hydrology baseline. Maximum monthly values taken over the extended dry period (1987 through 1992) were used to estimate critical dry year (1977) TOC concentrations.

An overall blended SFPUC baseline water quality was established by combining the source water qualities and supply quantities (projected water quality entering BDPLs)[6]. A SWP water quality baseline was developed from the water quality estimates for SWP deliveries developed by the CALFED Los Vaqueros Studies (using DSM II) in conjunction with historical DOC data, as described above.

Critical Dry Year Analysis

Figures C-4a through C-4c show the critical year baseline values for TOC, TDS and bromide by source, on a calendar year and water year basis, with 1977 being taken as critical year hydrology.

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[6] Details on development of SFPUC regional system baseline water quality are contained in the SFPUC Water Supply and Water Quality Baseline document.

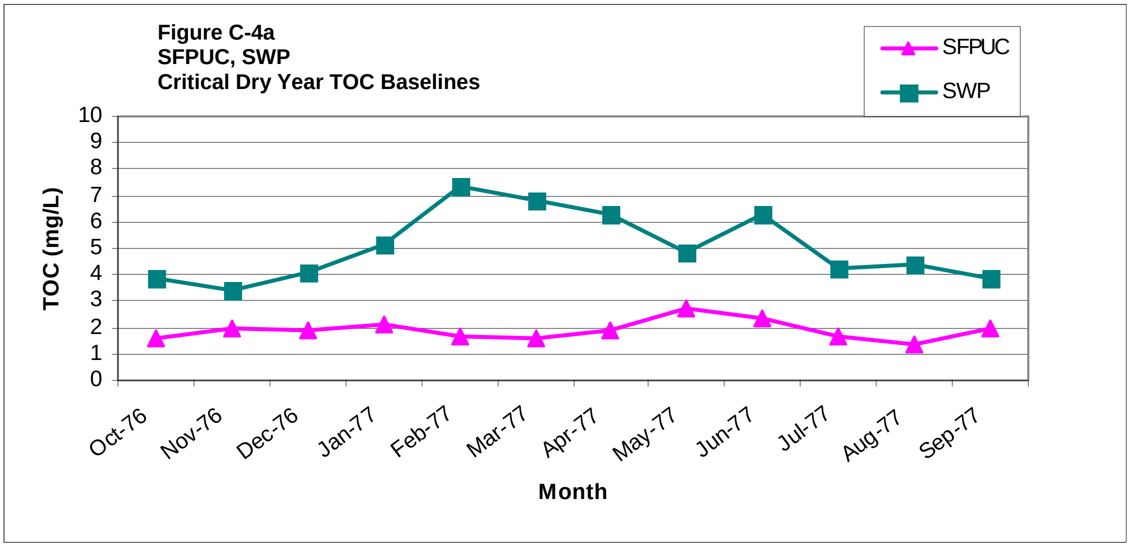


Figure C-4a
SFPUC, SWP
Critical Dry Year TOC Baselines

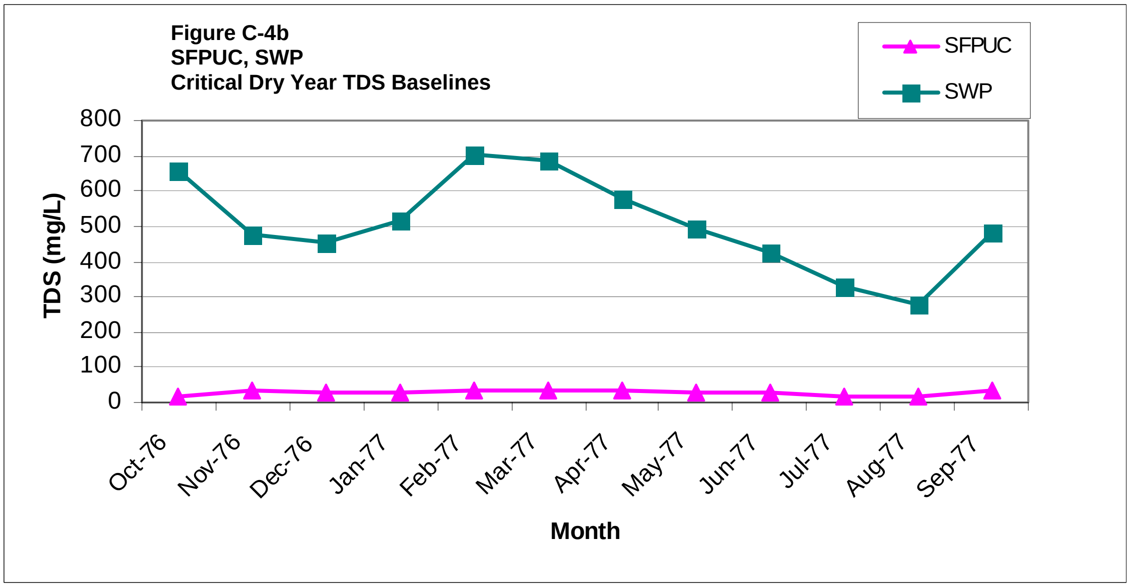


Figure C-4b
SFPUC, SWP
Critical Dry Year TDS Baselines

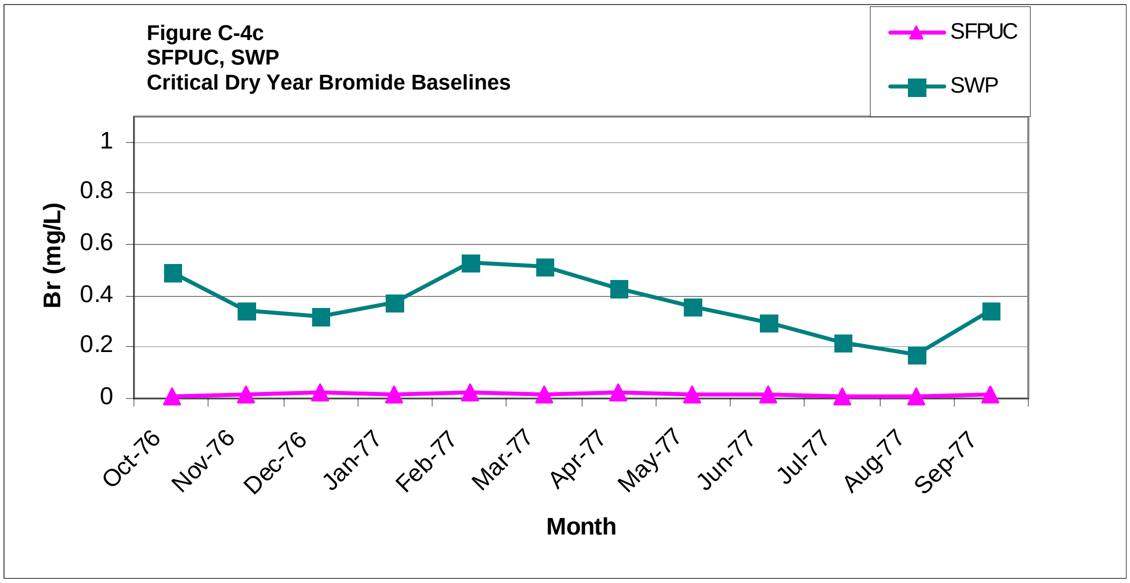
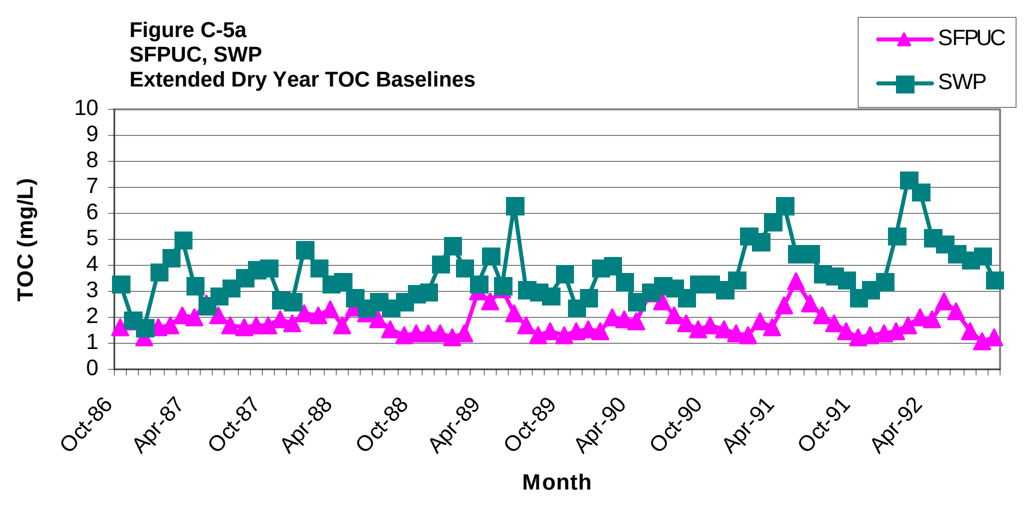
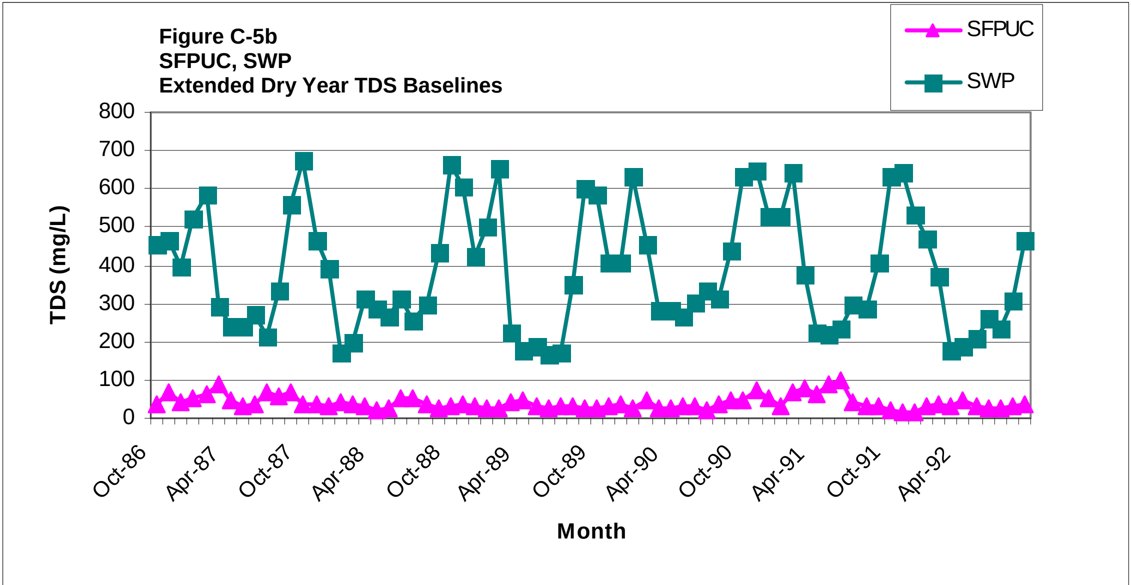


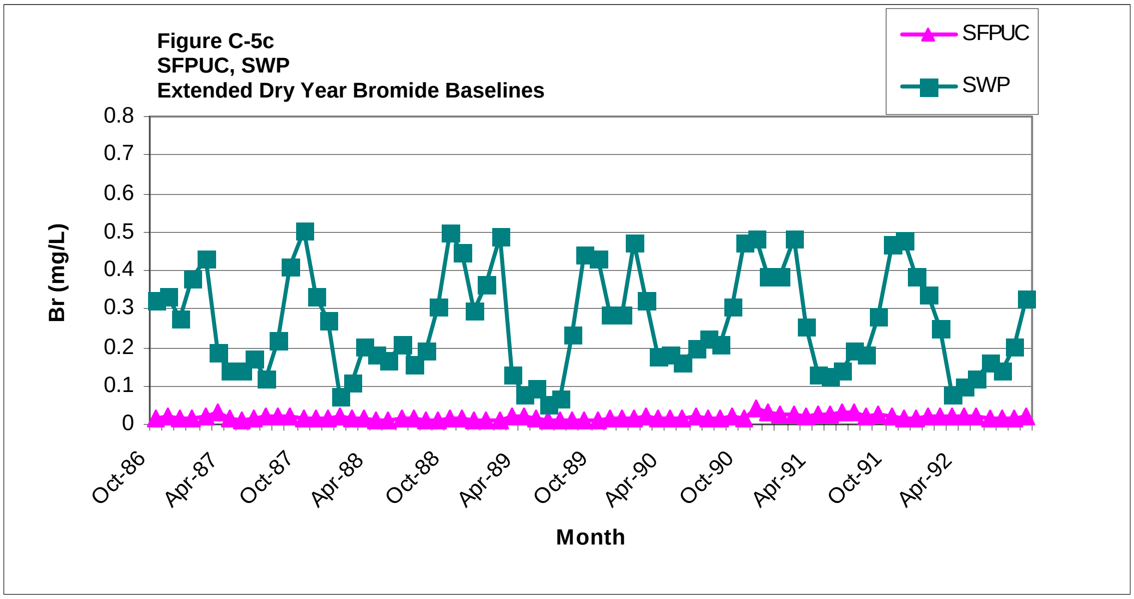
Figure C-4c
SFPUC, SWP
Critical Dry Year Bromide Baselines

Extended Dry Year Analysis

Figures C-5a, C-5b, and C-5c show the extended dry year baseline values for TOC, TDS and bromide by source, with water years 1987 through 1992 being taken as critical year hydrology.

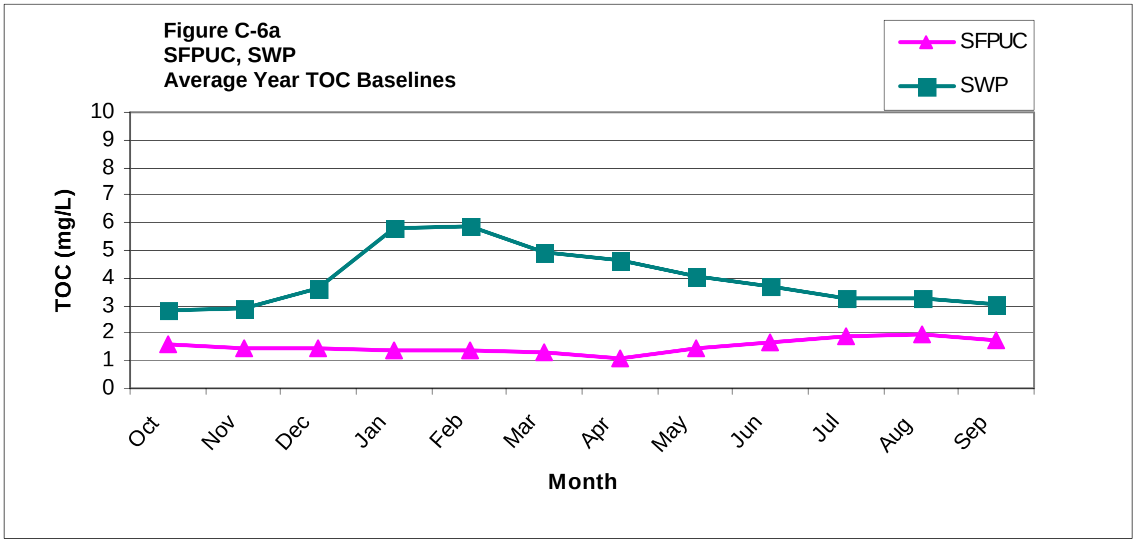






Average Hydrologic Year Analysis

Figure C-6a, C-6b and C-6c show the average year baseline values for each constituent and source. Long term averages were used for SWP average year hydrology, and monthly averages of 1994 through 1998 data were taken as average year hydrology for SFPUC.



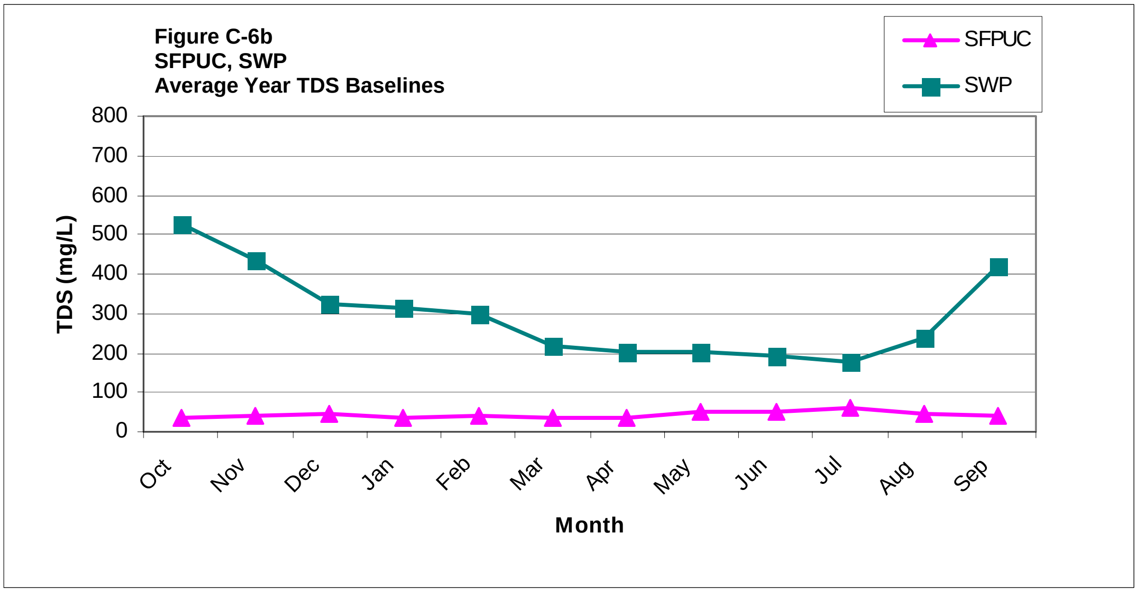


Figure C-6b
SFPUC, SWP
Average Year TDS Baselines
SFPUC
SWP
TDS (mg/L)
800
700
600
500
400
300
200
100
0
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Month

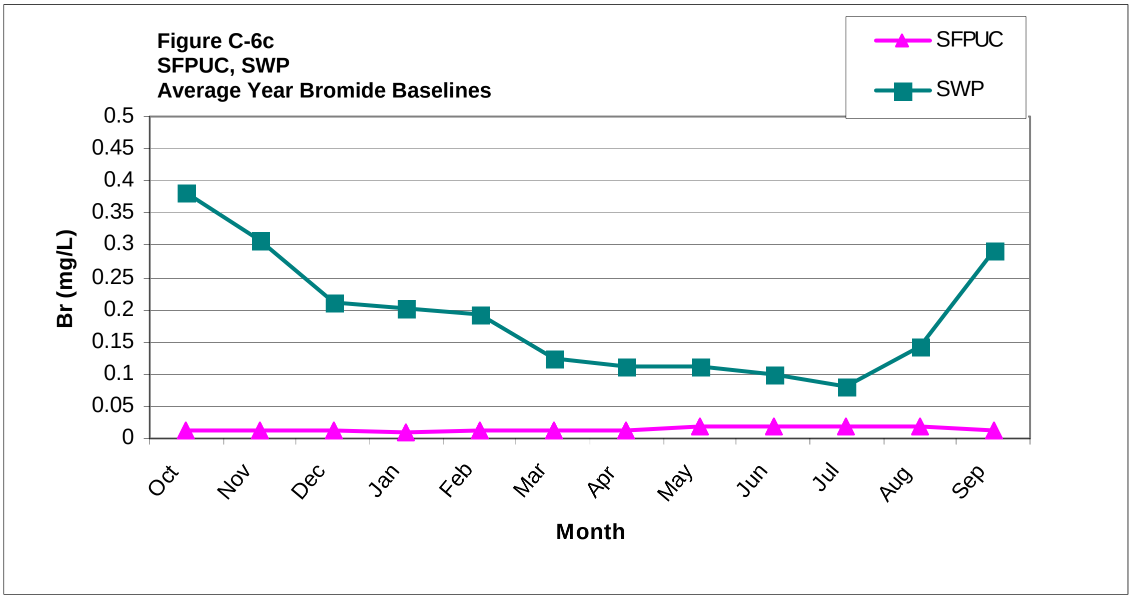


Figure C-6c
SFPUC, SWP
Average Year Bromide Baselines
SFPUC
SWP
Br (mg/L)
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Month

3.2 Bay Area Water Supply and Conservation Agency (BAWSCA)

3.2.1 Water Supply Data and Baselines

This section provides a brief discussion of the water supply data that has been collected, as well as any historical anomalies that could lead to uncharacteristic data being included in the baseline.

Overview

Supplies

- San Francisco Public Utilities Commission (SFPUC) Supplies
- Santa Clara Valley Water District (SCVWD) Supplies
- Local groundwater – not included in this study
- Local surface water – not included in this study
- Local recycling – not included in this study

The BAWSCA agencies receive supplies from the SFPUC regional system, the SCVWD system, and the State Water Project (ACWD only). Additionally, many BAWSCA agencies have individually developed local supplies including surface water, groundwater, and recycled water. For the SFPUC supplies, both water supply and water quality changes are estimated at the Bay Division Pipelines (BDPLs) connection to the Irvington Tunnel. For the SCVWD supplies, water supply and water quality are estimated as a combination of CVP water conveyed through San Luis Reservoir and State Water Project water. Local supplies were not evaluated as part of this study.

In December 2004, the *SFPUC Wholesale Customer Water Demand Projections* and *SFPUC Wholesale Customer Water Conservation Potential* Technical Reports were published. These reports present a comprehensive total demand projection for the BAWSCA agencies to the year 2030 and a corresponding detailed analysis of the conservation potential in the BAWSCA agencies' service areas. The updated information from these reports was used for this study.

The 2000-2001 and 2001-2002 BAWUA Annual Reports, which contain annual SFPUC and SCVWD purchase projections for the BAWSCA agencies for the years 2000 through 2020, were reviewed. The reports summarize historical and projected annual demands, supplies, and populations by agency. The Interim Water Shortage Allocation Plan Among Suburban Purchasers which contains a detailed methodology for assigning supply cutbacks when the SFPUC has determined that a system-wide water shortage of 20 percent or less were also reviewed.

In addition, monthly water supply and consumption reports have been compiled for SFPUC dating from 1962 through 1998. These reports, prepared by the Water Supply

& Treatment Division, summarize monthly demands, supplies, and reservoir levels, and compare current month conditions with the past year. The reports separate demands into South Bay and Peninsula (serving SFPUC wholesale customers, BAWSCA member agencies) and San Francisco (serving SFPUC retail customers)[7].

For CALFED studies, the CalSim II water resources simulation model of the State Water Project/Central Valley Project system and Delta Simulation Model (DSM) II are being used to evaluate Delta operations, project supply yields, and associated water quality effects for existing and future operational scenarios. The CALFED Common Assumptions Workgroup has established the Common Assumptions simulation runs that are being used for various CALFED studies, so that individual studies use consistent analysis scenarios. This project is consistent with the Common Assumptions simulations runs, which are based on the Central Valley Project Operations Criteria and Plan (OCAP) Study 4, with South Bay Aqueduct operations as updated by the Expanded Los Vaqueros Studies team,[8] for agencies receiving State or Federal water from the Sacramento-San Joaquin Delta.

Dry-year SFPUC supply baselines for BAWSCA member agencies (SFPUC wholesale customers)[9] were developed using the historical South Bay and Peninsula SFPUC regional system demand data.

Average year BAWSCA member agency demand projections were revised in September of 2004. These revised projections do not differentiate between expected supply sources. No attempt will be made to develop monthly supply baselines by source for the future, average year condition. Sections 3.5 and 3.6 provide detailed information regarding SCVWD and SFPUC water supplies, respectively.

The simulated Common Assumptions year 2020 baseline SWP and OCAP Study 4 CVP supplies were used develop distributions for critical dry and extended dry year baseline SCVWD supplies to BAWSCA member agencies. To simulate reduction in annual supply due to critical and extended dry year hydrology, the projected average year BAWSCA member agency purchases indicated in the BAWUA Annual Report have been reduced in proportion to simulated SCVWD supply reductions. By applying the simulated critical dry and extended dry SCVWD monthly supply distributions to this reduced annual supply, critical year and extended dry year SCVWD supply distributions to BAWSCA member agencies have been developed.

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[7] Historical SFPUC supply data was adjusted after consultation with SFPUC to exclude lower Cherry Aqueduct and South Bay Aqueduct deliveries that occurred historically during drought years.

[8] SWP deliveries from the Expanded Los Vaqueros studies were used for SCVWD. ACWD provided baseline supply projections based on OCAP Study 4.

[9] Note: 1988, 1989, and 1990 historical annual SFPUC wholesale customers purchases were subject to cutbacks of less than 20 percent. For those years, the historical SFPUC wholesale customer cutbacks were altered as outlined in the Interim Water Shortage Allocation Plan Among Suburban Purchasers, 11/ 16/2000.

Supply data is presented below, and is summarized in Table C-2.

Table C-2
BAWSCA Member Agencies Water Supply Baseline (MGD)

Month	*A*	*B*	*A+B*	*C*	*D*	*E*	*D+E*	*A+B+C-D*	*A+B+C+E*
	SFPUC Supply (without ACWD)	*SFPUC Supply to ACWD*	*Total SFPUC Supply*	*SWP Supply to ACWD*	*SFPUC Supply to Common Customers*	*SCVWD Supply to Common Customers*	*Total Supply to Common Customers*	*Total Supply (Without Common Customers)*	*Total Supply (without Local Sources)*
Critical Dry Year									
Oct-1976	173.6	12.7	186.3	24.0	34.4	16.7	51.1	175.9	227.0
Nov-1976	81.5	6.0	87.4	22.0	16.1	20.3	36.4	93.3	129.7
Dec-1976	73.8	5.4	79.2	22.0	14.6	18.5	33.1	86.6	119.7
Jan-1977	65.9	4.8	70.7	16.0	13.1	13.6	26.6	73.7	100.3
Feb-1977	58.6	4.3	62.8	16.0	11.6	10.2	21.8	67.2	89.0
Mar-1977	61.8	4.5	66.4	16.0	12.2	17.4	29.7	70.1	99.8
Apr-1977	73.9	5.4	79.3	16.0	14.6	18.2	32.8	80.7	113.5
May-1977	67.2	4.9	72.1	17.4	13.3	17.3	30.6	76.2	106.8
Jun-1977	80.5	5.9	86.4	23.2	15.9	18.6	34.5	93.7	128.2
Jul-1977	85.2	6.2	91.4	24.0	16.9	19.4	36.3	98.6	134.8
Aug-1977	82.1	6.0	88.2	24.0	16.3	20.1	36.4	95.9	132.2
Sep-1977	70.6	5.2	75.7	0.0	14.0	19.4	33.4	61.8	95.2
WY Average	81.2	5.9	87.2	18.4	16.1	17.5	33.6	89.5	123.0
WY Average (AFY)	90,980	6,650	97,640	20,590	18,020	19,570	37,590	100,210	137,800
Extended Dry Year									
Oct-86	172.1	22.0	194.0	24.0	48.1	19.4	67.5	170.0	237.5
Nov-86	170.7	6.2	176.9	24.0	43.8	25.4	69.3	157.0	226.3
Dec-86	136.9	2.2	139.1	23.3	34.5	23.7	58.2	127.9	186.1
Jan-87	123.5	3.6	127.2	21.4	31.5	20.4	51.9	117.1	168.9
Feb-87	122.3	4.4	126.6	19.2	31.4	14.4	45.8	114.4	160.2
Mar-87	141.3	4.8	146.2	21.6	36.2	20.1	56.3	131.6	187.9
Apr-87	200.8	7.4	208.1	25.0	51.6	21.7	73.3	181.6	254.9
May-87	220.9	20.2	241.0	26.5	59.7	21.9	81.6	207.8	289.4
Jun-87	229.8	23.1	252.9	27.0	62.7	23.1	85.7	217.3	303.0
Jul-87	228.1	23.9	252.0	27.0	62.4	24.0	86.4	216.6	303.0
Aug-87	232.8	23.9	256.7	27.0	63.6	24.9	88.5	220.1	308.6
Sep-87	217.9	19.0	236.9	26.0	58.7	25.4	84.1	204.2	288.3
Oct-87	173.2	17.7	190.9	24.0	37.2	16.9	54.1	177.7	231.8
Nov-87	133.5	5.0	138.5	24.0	27.0	20.6	47.6	135.5	183.1
Dec-87	138.7	1.7	140.5	23.3	27.4	18.9	46.2	136.4	182.6
Jan-88	105.3	2.9	108.2	16.0	21.1	14.9	36.0	103.1	139.1
Feb-88	132.3	3.5	135.8	16.6	26.5	11.0	37.4	125.9	163.4
Mar-88	156.2	3.9	160.1	16.0	31.2	15.4	46.6	144.9	191.5
Apr-88	152.9	5.9	158.9	16.0	31.0	16.1	47.1	143.9	191.0
May-88	141.6	16.2	157.9	16.0	30.8	17.4	48.2	143.1	191.3
Jun-88	151.7	18.6	170.3	19.0	33.2	17.3	50.5	156.1	206.7
Jul-88	157.3	19.2	176.5	23.0	34.4	18.0	52.4	165.1	217.5
Aug-88	149.9	19.2	169.2	27.0	33.0	18.6	51.5	163.2	214.7
Sep-88	132.3	15.3	147.5	26.3	28.7	17.7	46.5	145.1	191.6
Oct-88	78.6	16.0	94.7	22.0	16.7	14.6	31.3	99.9	131.2
Nov-88	93.3	4.5	97.8	9.5	17.3	16.3	33.5	90.0	123.6
Dec-88	89.9	1.6	91.4	1.6	16.2	15.1	31.3	76.8	108.1
Jan-89	97.9	2.6	100.5	22.0	17.8	15.1	32.9	104.8	137.7
Feb-89	95.7	3.2	98.9	22.0	17.5	12.2	29.6	103.4	133.1
Mar-89	91.4	3.5	94.9	24.0	16.8	15.6	32.3	102.1	134.5
Apr-89	130.1	5.4	135.4	24.0	23.9	19.3	43.3	135.5	178.8
May-89	151.5	14.7	166.2	27.0	29.4	18.1	47.5	163.8	211.3
Jun-89	183.3	16.9	200.2	29.0	35.4	19.0	54.4	193.8	248.2
Jul-89	189.9	17.4	207.3	29.0	36.6	19.8	56.5	199.7	256.2
Aug-89	192.7	17.4	210.1	29.0	37.1	20.7	57.8	202.0	259.8
Sep-89	169.7	13.9	183.6	29.0	32.4	22.5	54.9	180.1	235.1
Oct-89	150.5	16.0	166.6	25.0	30.1	17.3	47.4	161.4	208.9
Nov-89	141.3	4.5	145.8	22.0	26.4	22.3	48.7	141.5	190.2
Dec-89	119.6	1.6	121.2	22.0	21.9	20.7	42.6	121.3	163.9
Jan-90	109.0	2.6	111.6	16.0	20.2	15.3	35.5	107.4	142.9
Feb-90	93.8	3.2	97.0	16.0	17.5	11.3	28.8	95.4	124.2

Table C-2
BAWSCA Member Agencies Water Supply Baseline (MGD)

Month	A	B	A+B	C	D	E	D+E	A+B+C-D	A+B+C+E
	SFPUC Supply (without ACWD)	SFPUC Supply to ACWD	Total SFPUC Supply	SWP Supply to ACWD	SFPUC Supply to Common Customers	SCVWD Supply to Common Customers	Total Supply to Common Customers	Total Supply (Without Common Customers)	Total Supply (without Local Sources)
Mar-90	111.1	3.5	114.6	20.8	20.7	15.5	36.2	114.7	150.9
Apr-90	132.9	5.4	138.2	22.4	25.0	16.4	41.4	135.6	177.0
May-90	132.6	14.7	147.4	27.0	26.7	18.2	44.9	147.7	192.6
Jun-90	144.7	16.9	161.6	27.5	29.2	18.2	47.4	159.9	207.3
Jul-90	145.0	17.4	162.4	25.0	29.4	18.9	48.2	158.1	206.3
Aug-90	149.1	17.4	166.6	25.0	30.1	19.3	49.4	161.4	210.9
Sep-90	134.3	13.9	148.1	24.5	26.8	18.0	44.8	145.9	190.6
Oct-90	117.6	13.2	130.8	22.0	19.5	13.9	33.4	133.3	166.7
Nov-90	94.7	3.7	98.4	21.0	14.7	15.4	30.1	104.8	134.9
Dec-90	100.7	1.3	102.0	17.0	15.2	14.1	29.3	103.8	133.1
Jan-91	93.5	2.2	95.7	20.0	14.3	12.1	26.4	101.4	127.8
Feb-91	87.5	2.6	90.2	20.0	13.4	9.7	23.1	96.7	119.9
Mar-91	87.2	2.9	90.1	21.8	13.4	17.3	30.7	98.5	129.2
Apr-91	102.1	4.4	106.5	25.0	15.9	17.6	33.5	115.7	149.2
May-91	116.7	12.1	128.9	29.0	19.2	18.9	38.1	138.7	176.8
Jun-91	124.7	13.9	138.6	29.0	20.7	18.9	39.5	146.9	186.4
Jul-91	141.3	14.4	155.6	28.0	23.2	19.7	42.9	160.4	203.3
Aug-91	131.6	14.4	146.0	26.0	21.8	20.4	42.2	150.2	192.4
Sep-91	124.5	11.4	135.9	24.0	20.3	19.7	39.9	139.6	179.6
Oct-91	112.9	14.4	127.3	24.0	20.7	16.6	37.3	130.6	167.9
Nov-91	100.9	4.0	104.9	14.2	17.0	19.1	36.1	102.1	138.3
Dec-91	97.0	1.4	98.4	0.3	16.0	17.7	33.7	82.7	116.4
Jan-92	88.0	2.4	90.4	22.0	14.7	13.3	28.0	97.7	125.7
Feb-92	84.8	2.9	87.7	22.8	14.2	9.6	23.8	96.3	120.1
Mar-92	95.2	3.2	98.3	24.0	16.0	18.3	34.2	106.4	140.6
Apr-92	151.3	4.8	156.1	25.0	25.3	19.7	45.1	155.7	200.8
May-92	137.5	13.2	150.8	29.0	24.5	21.0	45.4	155.3	200.7
Jun-92	141.8	15.2	157.0	29.0	25.5	22.3	47.8	160.5	208.3
Jul-92	142.5	15.7	158.1	29.0	25.7	23.3	48.9	161.5	210.4
Aug-92	151.1	15.7	166.7	29.0	27.1	24.2	51.2	168.7	219.9
Sep-92	136.3	12.4	148.7	29.0	24.1	23.5	47.6	153.6	201.2
Average	136.3	10.1	146.4	22.8	27.9	18.2	46.1	141.2	187.4
Average (AFY)	152,640	11,290	163,940	25,520	31,250	20,440	51,690	158,210	209,900

Critical Dry Year Analysis (WY 1977)

Figure C-7 shows critical year supplies for all BAWSCA member agencies for water year 1977, broken out into SFPUC supplies to common customers[10], SCVWD supplies to common customers (SWP and CVP), SFPUC and SWP supplies to ACWD, and SFPUC supplies to non-common customers.

- Total critical year supply for all BAWSCA member agencies without ACWD is projected to be 99 MGD (111,000 AFY), with 81 MGD (91,000 AFY) from SFPUC supplies and 18 MGD (20,000 AFY) from SCVWD supplies. Annual ACWD SFPUC and SWP purchases are expected to be 24 MGD (27,000 AFY).

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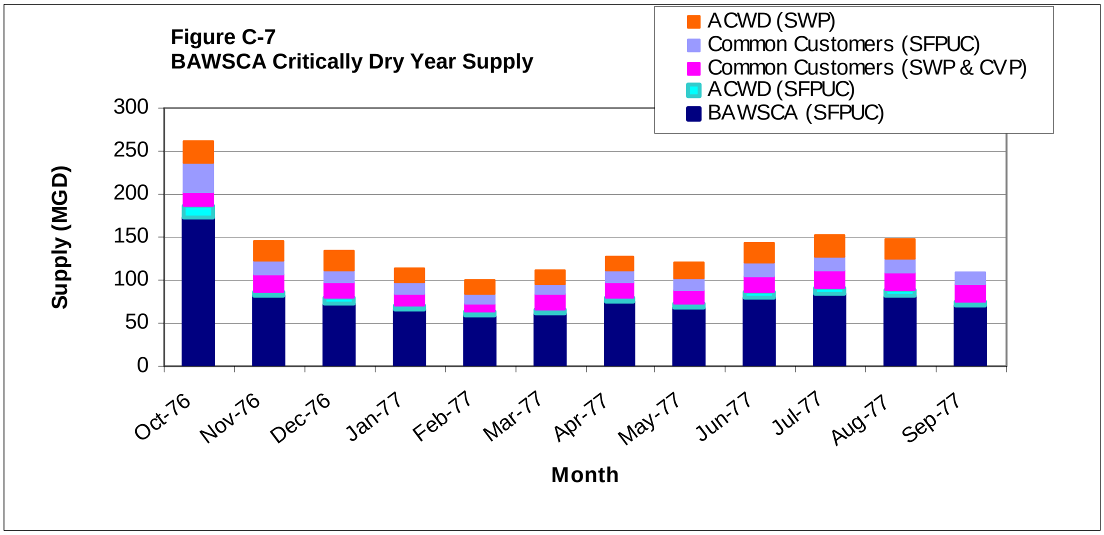
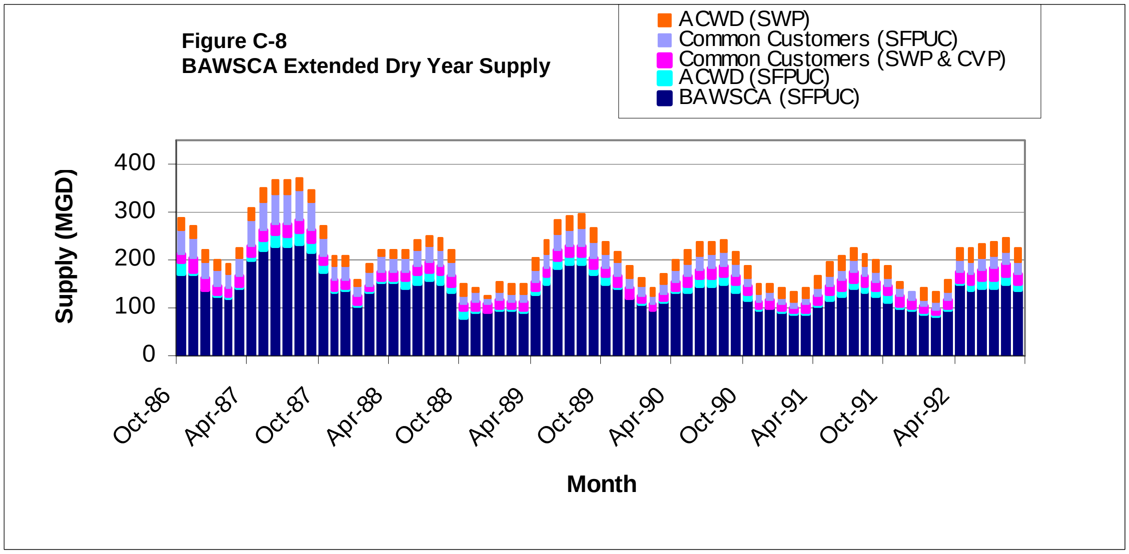
[10] The term "Common Customers" as used in Table C-2 and Figures C-7 and C-8 refers to those agencies receiving supply from both SFPUC and SCVWD, including Milpitas, Mountain View, North San Jose, Santa Clara and Sunnyvale.



Extended Dry Year Analysis (WY 1987-1992)

Figure C-8 shows drought year supplies.

- Average extended dry year supply for all BAWSCA member agencies without ACWD is projected to be 154 MGD (172,000 AFY), with 136 MGD (153,000 AFY) from SFPUC supplies and 18 MGD (20,000 AFY) from SCVWD supplies. Annual ACWD SFPUC and SWP demand is projected to average 33 MGD (37,000 AFY).



Average Year Analysis (WY 1994-1998, 1984)

Projected year 2020 demands will be used as an estimate of year 2020 supply. This is a simplifying assumption used at this time for this study. This study was not designed to examine future water supply shortfalls. The SFPUC is currently determining the water supply reliability goal for the SFPUC Regional Water System as part of the Program EIR for the SFPUC Regional Water System CIP. Independently and in conjunction with the SFPUC, BAWSCA and its member agencies are examining current and future water supply reliability in their service areas. No attempt will be made to partition this supply between sources.

3.2.2 Water Quality Data and Baselines

BAWSCA member agencies purchase treated water from the SCVWD and SFPUC systems. They expect a threshold water quality from these providers. At the request of BAWSCA, no analysis as to the direct benefit or impact of concept implementation on BAWSCA member agencies water quality will be performed. Analysis will be performed for the SCVWD and SFPUC supplies. Baseline water quality information for the SCVWD and SFPUC supplies is presented in Sections 3.5 and 3.6, respectively.

3.3 Contra Costa Water District (CCWD)

3.3.1 Water Supply Data and Baselines

This section provides a brief discussion of the water supply data that has been collected, as well as any historical anomalies that could lead to uncharacteristic data being included in the baseline.

Overview

Supplies

- Central Valley Project Supply
- Los Vaqueros Water Rights (used in lieu of CVP supplies when available)
- San Joaquin River Supplies (Mallard Slough Water Rights, City of Antioch, and Industrial)
- ECCID – not included in this study

CCWD’s supplies are diverted or delivered through the following facilities:

- Rock Slough
- Old River
- Los Vaqueros Reservoir (releases for water quality or fish protection purposes)
- Mallard Slough – not included in this study

CCWD is almost entirely dependent on the Delta for its water supply. CCWD's primary source is the United States Bureau of Reclamation's Central Valley Project (CVP). CCWD’s contract with Reclamation provides up to 195,000 acre-feet per year, depending on many factors including hydrologic conditions and implementation of Federal and State laws. Other CCWD sources include the Los Vaqueros Water Rights and San Joaquin River supplies.

Under the Los Vaqueros Water Rights, CCWD can divert excess Delta flows to Los Vaqueros Reservoir for storage between November 1 of each year and June 30 of the succeeding year. When Los Vaqueros Water Rights water is used, CVP supplies are reduced by a like amount. Little or no Los Vaqueros Water Rights water is available for diversion in dry years.

CCWD and some of its customers have additional water rights for diversion from the San Joaquin River. These supplies are variable because of poor water quality that often exists in the San Joaquin River. In dry years, little or no water is available from these sources.

CCWD receives supplies from direct diversions from Old River Pumping Plant and Rock Slough, as well as from the Los Vaqueros Reservoir. For the CCWD system, both water supply and water quality changes are estimated as water enters the District water treatment plants.

CCWD receives supplies from direct diversions from the Old River, Rock Slough, and Mallard Slough Intakes, as well as from water quality and fishery protection releases from the Los Vaqueros Reservoir. For the CCWD system, both water supply and water quality changes are estimated as water enters the District water treatment plants. Baseline conditions for existing facilities under 2020 level of demand used in this TM were developed as part of the Los Vaqueros Expansion Studies, and described as Operating Scenario 1B (Future Baseline): Future Demand/Existing Los Vaqueros Project in the *Draft Reservoir Operations, Operating Scenarios Assumptions, and Model Development Technical Memorandum.* The CalSim II water resources simulation model of the State Water Project/Central Valley Project system and Delta Simulation Model (DSM) II are being used to evaluate Los Vaqueros Reservoir and Delta operations, project supply yields, and associated water quality effects for existing and future operational scenarios. The Studies simulated supply and water quality (chloride) data for Rock Slough, Old River, Los Vaqueros Reservoir, and blended CCWD diversions. This data was used in conjunction with historical monitoring data to develop the water supply and water quality baselines for CCWD.

San Joaquin River Supplies are not modeled directly in the CALSIMII and DSMII models. Adjustments (i.e., reductions) are made to CCWD's demand to account for Mallard Slough diversions, diversions by the City of Antioch, industrial diversions for all year types in the Delta operations and hydrodynamic models. The adjusted demand is used to represent CCWD's demands in CALSIM II and DSMII.

Flow data for the three hydrologic periods to be used is summarized in Table C-3 and discussed below.

Table C-3
CCWD Water Supply Baseline (MGD)(1)

Month	***Los Vaqueros Reservoir***	***Rock Slough***	***Old River***	***Total***	***Month***(2)	***Los Vaqueros Reservoir***	***Rock Slough***	***Old River***	***Total***
Oct-76	0	0	158	158	Oct (Average Year)	0	0	150	150
Nov-76	0	0	131	131	Nov (Average Year)	5	0	95	101
Dec-76	0	0	119	119	Dec (Average Year)	8	0	64	72
Jan-77	0	0	116	116	Jan (Average Year)	2	0	66	68
Feb-77	0	0	128	128	Feb (Average Year)	1	0	74	76
Mar-77	0	56	56	112	Mar (Average Year)	0	0	69	69
Apr-77	0	0	145	145	Apr (Average Year)	92	0	0	92
May-77	0	21	156	177	May (Average Year)	0	0	125	125
Jun-77	0	0	203	203	Jun (Average Year)	0	70	96	166
Jul-77	0	5	207	212	Jul (Average Year)	0	0	195	196
Aug-77	0	0	206	206	Aug (Average Year)	0	4	199	203
Sep-77	0	187	0	187	Sep (Average Year)	106	70	0	176
Average	0	22	135	158	Average	18	12	95	124
Average (AFY)	0	25,190	151,640	176,830	Average (AFY)	19,990	13,460	105,920	139,430
									Extended Dry Year
Oct-1986	99	51	0	150.0	Oct-1989	5	0	154	159
Nov-1986	68	0	33	100.7	Nov-1989	0	0	129	129
Dec-1986	38	0	34	72.1	Dec-1989	0	0	113	113
Jan-1987	47	21	0	68.0	Jan-1990	0	0	109	109
Feb-1987	56	22	0	78.2	Feb-1990	1	0	107	107
Mar-1987	0	45	42	90.9	Mar-1990	0	56	53	112
Apr-1987	133	0	0	133.3	Apr-1990	91	0	54	145
May-1987	0	0	162	161.9	May-1990	0	0	176	177
Jun-1987	0	190	0	189.6	Jun-1990	0	203	0	203
Jul-1987	0	134	73	212.0	Jul-1990	114	0	98	212
Aug-1987	106	0	100	206.0	Aug-1990	36	0	169	206
Sep-1987	150	0	37	186.5	Sep-1990	0	0	187	187
Oct-1987	132	0	27	159.0	Oct-1990	0	0	158	158
Nov-1987	88	0	41	128.6	Nov-1990	0	0	131	131
Dec-1987	11	0	102	112.7	Dec-1990	0	0	119	119
Jan-1988	0	0	109	109.1	Jan-1991	0	0	116	116
Feb-1988	0	26	82	103.5	Feb-1991	0	0	128	128
Mar-1988	0	31	79	112.4	Mar-1991	0	0	112	112
Apr-1988	145	0	0	144.7	Apr-1991	0	0	145	145
May-1988	0	0	177	176.8	May-1991	0	0	177	177
Jun-1988	0	203	0	203.0	Jun-1991	0	203	0	203
Jul-1988	0	207	1	211.7	Jul-1991	85	0	127	212
Aug-1988	90	0	116	205.6	Aug-1991	62	0	144	206
Sep-1988	143	0	44	187.5	Sep-1991	0	0	187	187
Oct-1988	56	0	102	158.4	Oct-1991	0	0	158	158
Nov-1988	0	0	131	130.5	Nov-1991	0	0	131	131
Dec-1988	1	0	119	119.4	Dec-1991	0	0	119	119
Jan-1989	0	0	116	116.2	Jan-1992	0	0	116	116
Feb-1989	0	128	0	128.1	Feb-1992	0	0	124	124
Mar-1989	0	45	42	90.9	Mar-1992	0	56	53	112
Apr-1989	95	0	39	133.3	Apr-1992	90	0	54	145
May-1989	0	0	161	161.9	May-1992	0	0	176	177
Jun-1989	0	112	78	189.6	Jun-1992	0	203	0	203
Jul-1989	0	134	73	212.0	Jul-1992	0	134	73	212
Aug-1989	125	0	81	206.0	Aug-1992	113	0	92	206
Sep-1989	154	0	32	186.5	Sep-1992	147	0	40	187
Average						34	31	87	152
Average (AFY)						38,590	34,320	97,400	170,810

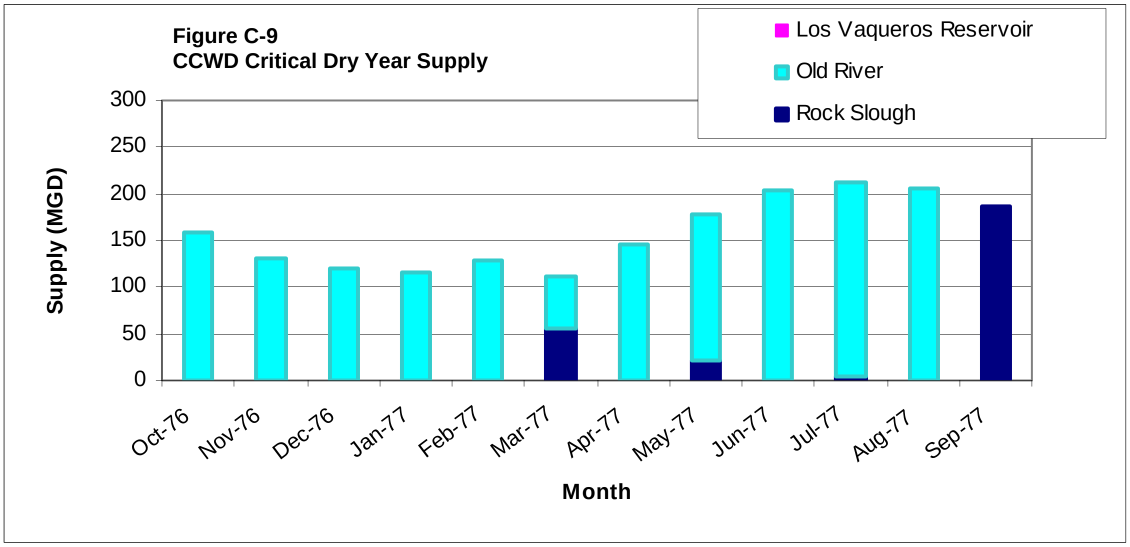
(1) Los Vaqueros Reservoir Expansion Studies, Operating Scenario 1B.
(2) Average year based on 1984 water year.

Critical Dry Year Analysis (WY 1977)

Figure C-9 shows critical year imported supplies for CCWD, broken out into Rock Slough, Old River, and Los Vaqueros supplies.

- Total critical year CCWD supply is projected to be 160 MGD (177,000 AFY), with 0 MGD (0 AFY) from Los Vaqueros Reservoir Drafts, 22 MGD (25,000 AFY) from Rock Slough diversions, and 135 MGD (152,000 AFY) from Old River diversions.

Figure C-9
CCWD Critical Dry Year Supply

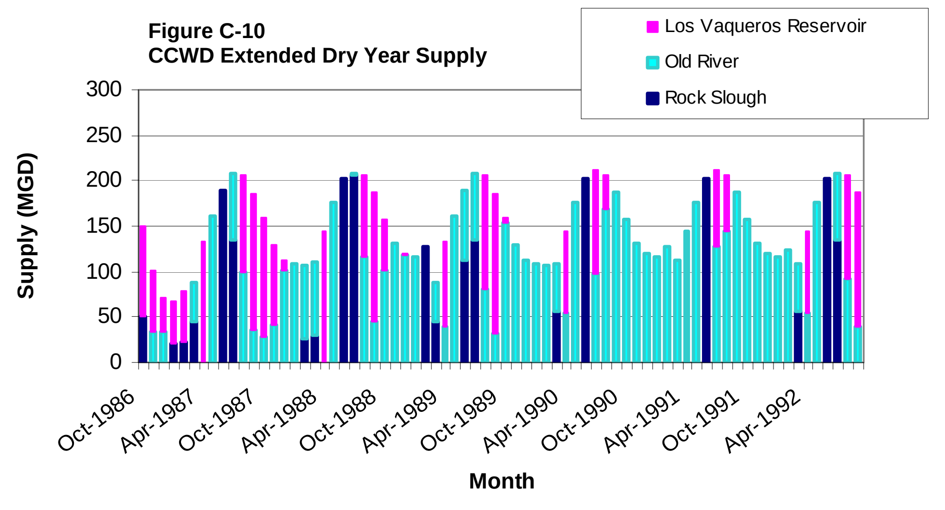


Extended Dry Year Analysis (WY 1987 - 1992)

Figure C-10 shows drought supplies.

- Average extended dry year CCWD supply is projected to be 150 MGD (171,000 AFY), with 34 MGD (39,000 AFY) from Los Vaqueros Reservoir Drafts, 31 MGD (34,000 AFY) from Rock Slough diversions, and 87 MGD (97,000 AFY) from Old River diversions.

Figure C-10
CCWD Extended Dry Year Supply

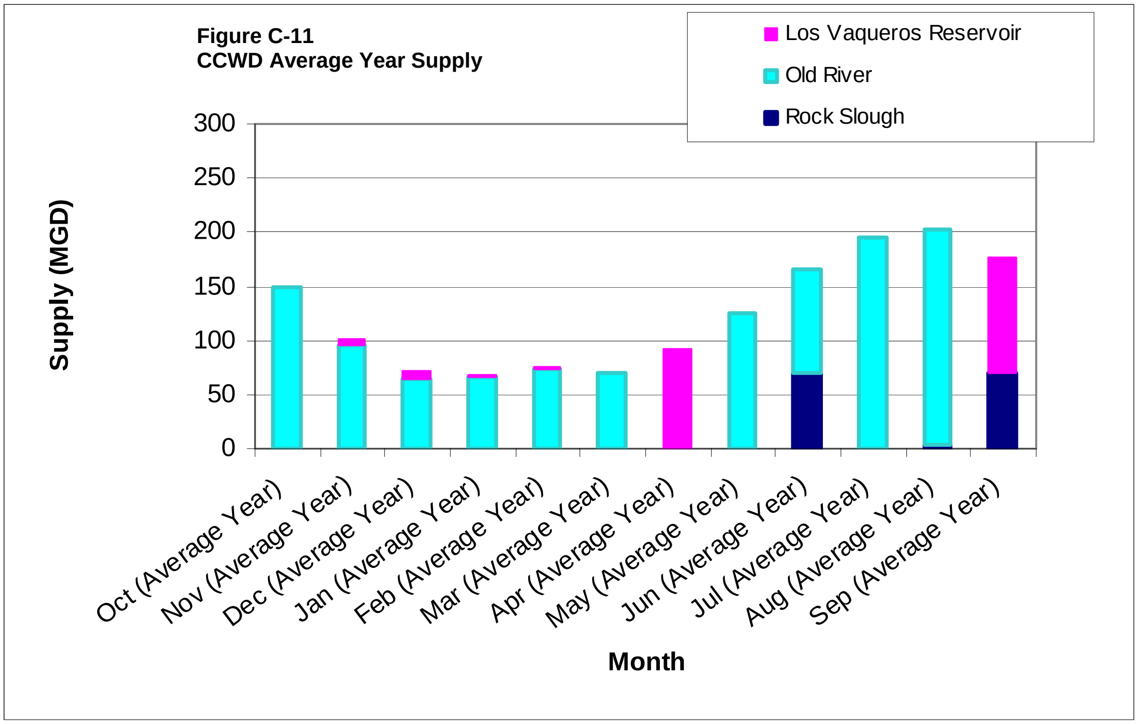


Average Year Analysis (WY 1984)

Figure C-11 shows average year supplies.

- Average year CCWD supply is projected to be 124 MGD (140,000 AFY), with 18 MGD (20,000 AFY) from Los Vaqueros Reservoir Drafts, 12 MGD (13,000 AFY) from Rock Slough diversions, and 95 MGD (105,000 AFY) from Old River diversions.

Figure C-11
CCWD Average Year Supply



3.3.2 Water Quality Data and Baselines

This section provides a brief discussion of the water quality data that has been collected, as well as methods implemented to fill in data gaps. In addition, any historical anomalies that could lead to uncharacteristic data being included in the baseline are identified.

Overview

CCWD water supply sources and facilities are described in Section 3.3.1

Water Quality Parameters

- **TOC** – monthly point concentrations have been compiled for the CCWD supplies. This data will be used for quantitative water quality and treatment analyses.

- **TDS** – simulated CCWD chloride data was converted to TDS. This data will be used for quantitative water quality and treatment analysis.
- **Bromide** - simulated CCWD chloride data was converted to bromide. This data will be used for quantitative water quality and treatment analysis.
- **Temperature, pH** – data from historical CCWD supplies will be used in a qualitative assessment. No formal baseline will be established for this data.

Available historical monthly TOC and DOC data from the Municipal Water Quality Investigations (MWQI) were collected for the years 1989 through 1994 and 1990 through 1998 for the Rock Slough and Old River sources, respectively. Los Vaqueros Reservoir monitoring TOC data for 2001 through 2003 were provided by the District.

As part of the Los Vaqueros Reservoir Expansion Studies, simulated chloride data for the period from 1921 through 1994 were developed using DSM II for the year 2020 demand scenario with existing facilities. The Los Vaqueros Reservoir Expansion Studies simulated the concentration of chlorides at Rock Slough, Los Vaqueros Reservoir, Old River, and Middle River, as well as water delivered to CCWD's service area for the future baseline condition[12]. Concentrations of bromide and TDS were calculated from the simulated chloride data. Estimates of blended TOC were calculated by performing a mass balance of Old River, Rock Slough, and Los Vaqueros TOC[13] using the simulated flow data developed by the Los Vaqueros Reservoir Expansion Studies.

Table C-4 presents the water quality data used to simulate each source.

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[12] Los Vaqueros Reservoir Expansion Studies, Operating Scenario 1B.

[13] A constant TOC value of 3.2 mg/L was assumed for the Los Vaqueros Reservoir.

Table C-4
CCWD Water Quality Data Sources

	Critical (1977)			***Extended Dry (1987-1992)***			***Average Year***		
	Rock Slough	***Old River***	***Los Vaqueros Reservoir Expansion***	***Rock Slough***	***Old River***	***Los Vaqueros Reservoir Expansion***	***Rock Slough***	***Old River***	***Los Vaqueros Reservoir Expansion***
TOC	Average of available monthly critical year data (1988, 1990, 1991, 1992, 1994)	Average of available monthly critical year data (1988, 1990, 1991, 1992, 1994)	Average value taken as 3.2 mg/L	1986 – 1992 MWQI data	Average of available monthly critical year data (1988, 1990, 1991, 1992, 1994), historical 1990-1992 MWQI data	Average value taken as 3.2 mg/L	Monthly averages of 1986-1994 data	Monthly averages of 1990-1998 MWQI data	Average value taken as 3.2 mg/L
TDS	Converted from Los Vaqueros Reservoir Expansion simulated chloride data	Converted from Los Vaqueros Reservoir Expansion simulated chloride data	Converted from Los Vaqueros Reservoir Expansion simulated chloride data	Converted from Los Vaqueros Reservoir Expansion simulated chloride data	Converted from Los Vaqueros Reservoir Expansion simulated chloride data	Converted from Los Vaqueros Reservoir Expansion simulated chloride data	Converted from Los Vaqueros Reservoir Expansion simulated chloride data	Converted from Los Vaqueros Reservoir Expansion simulated chloride data	Converted from Los Vaqueros Reservoir Expansion simulated chloride data
Bromide	Converted from Los Vaqueros Reservoir Expansion simulated chloride data	Converted from Los Vaqueros Reservoir Expansion simulated chloride data	Converted from Los Vaqueros Reservoir Expansion simulated chloride data	Converted from Los Vaqueros Reservoir Expansion simulated chloride data	Converted from Los Vaqueros Reservoir Expansion simulated chloride data	Converted from Los Vaqueros Reservoir Expansion simulated chloride data	Converted from Los Vaqueros Reservoir Expansion simulated chloride data	Converted from Los Vaqueros Reservoir Expansion simulated chloride data	Converted from Los Vaqueros Reservoir Expansion simulated chloride data

Critical Dry Year Analysis

Figures C-12a through C-12c show the critical year baseline values for TOC, TDS and bromide by source, on a calendar year and water year basis, with 1977 being taken as critical year hydrology.

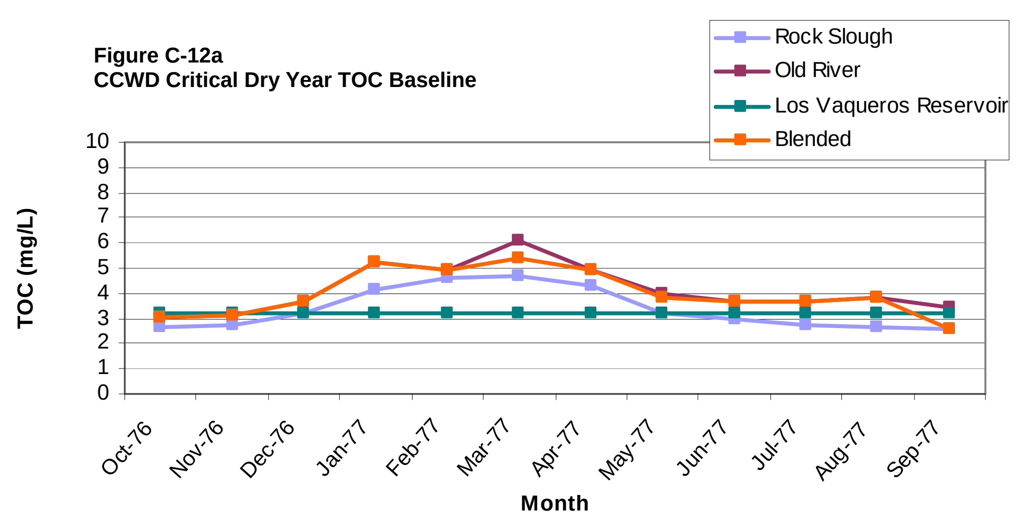
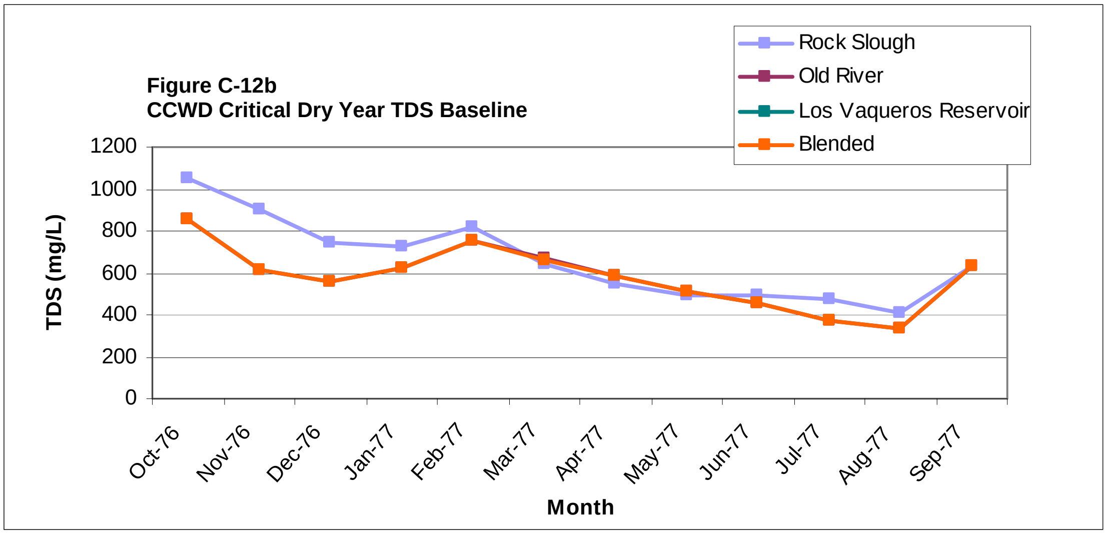
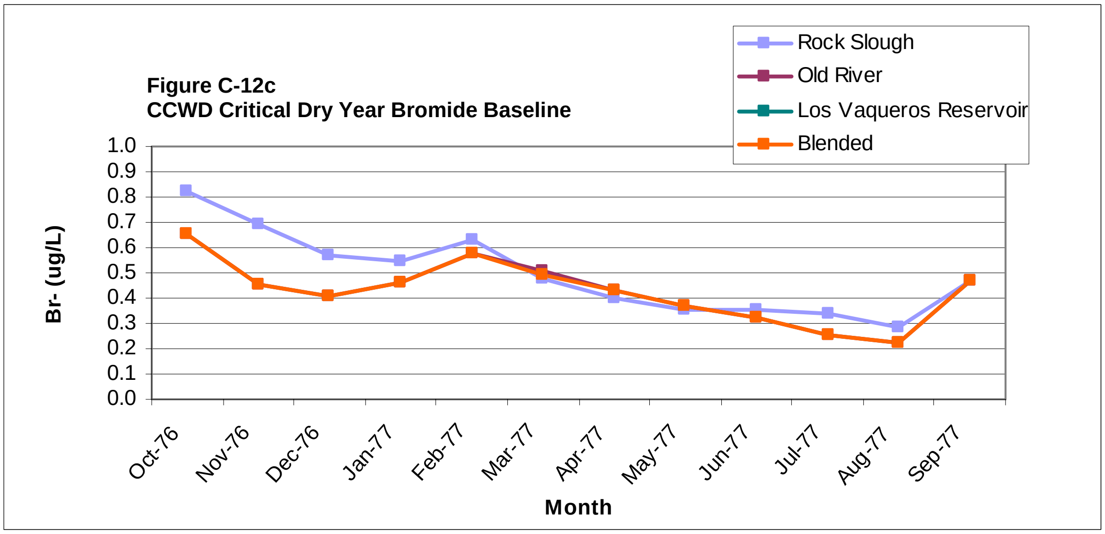


Figure C-12a
CCWD Critical Dry Year TOC Baseline





Extended Dry Year Analysis

Figures C-13a, C-13b, and C-13c show the extended dry year baseline values for TOC, TDS and bromide by source, with water years 1987 through 1992 being taken as critical year hydrology.

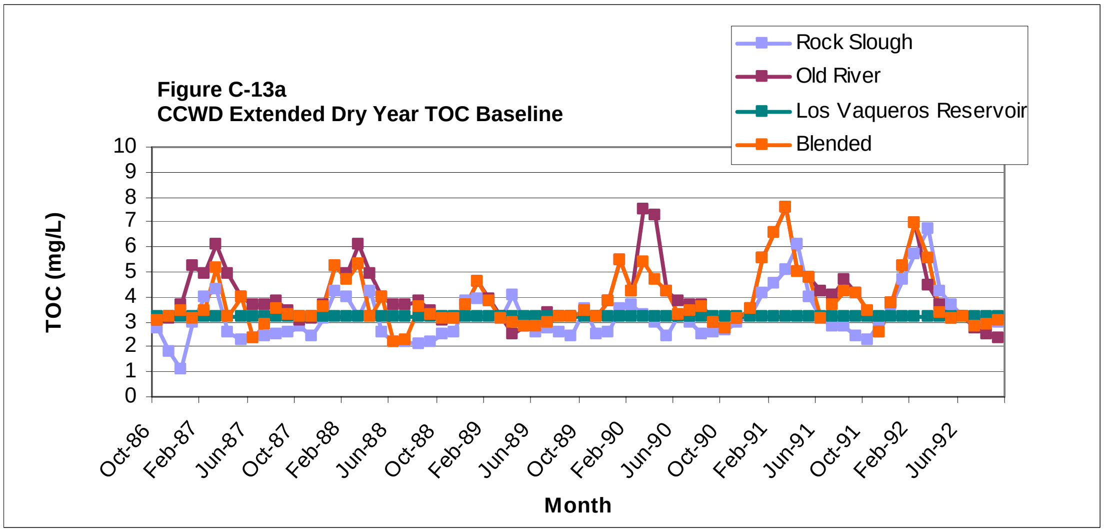


Figure C-13a
CCWD Extended Dry Year TOC Baseline

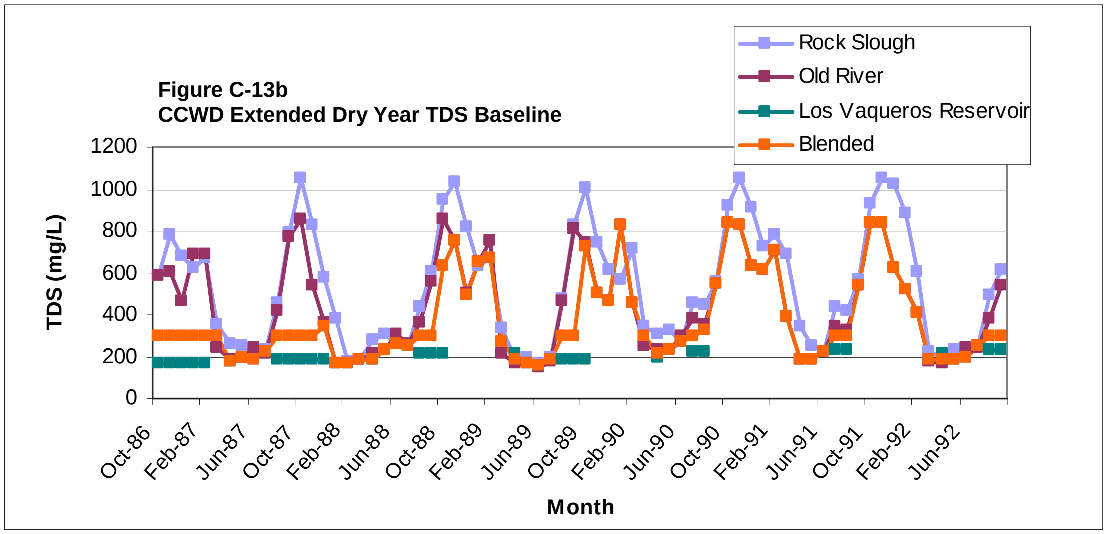


Figure C-13b
CCWD Extended Dry Year TDS Baseline

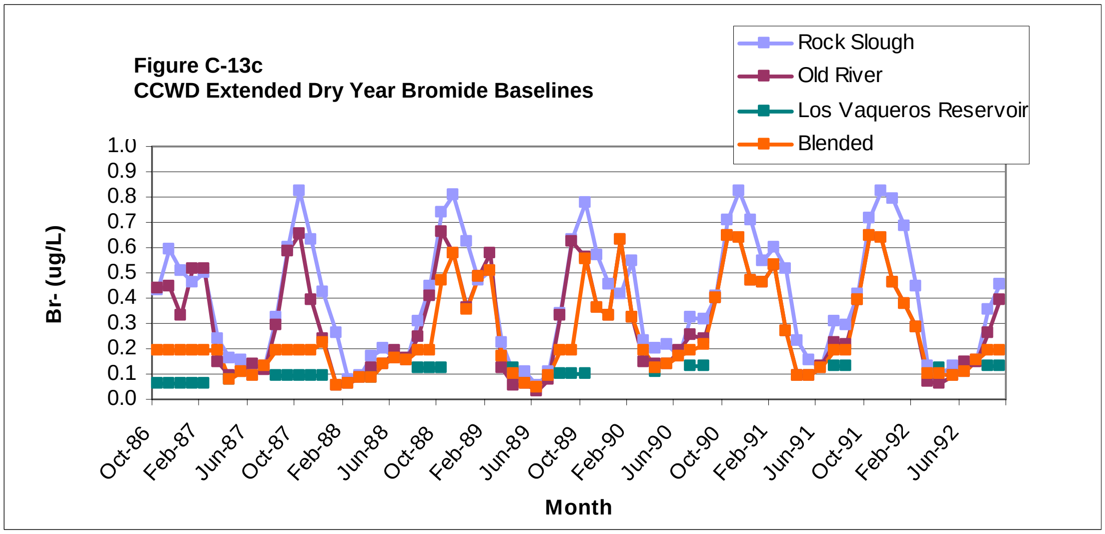
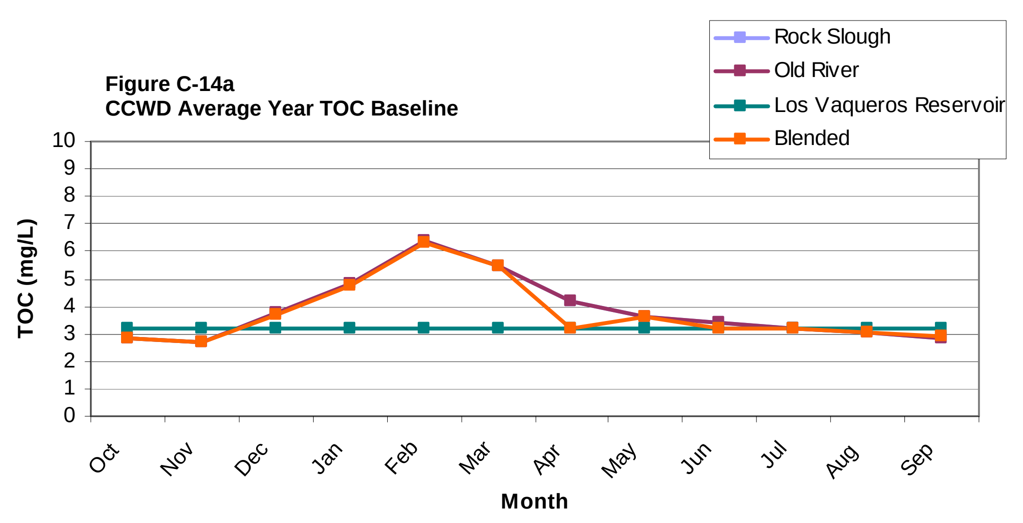


Figure C-13c
CCWD Extended Dry Year Bromide Baselines

Average Hydrologic Year Analysis

Figure C-14a, C-14b and C-14c show the average year baseline values for each constituent and source. 1984 was used as average year supply conditions for performing a mass balance to develop delivered TOC. Long term monthly average simulated chloride concentrations were converted to bromide and TDS.



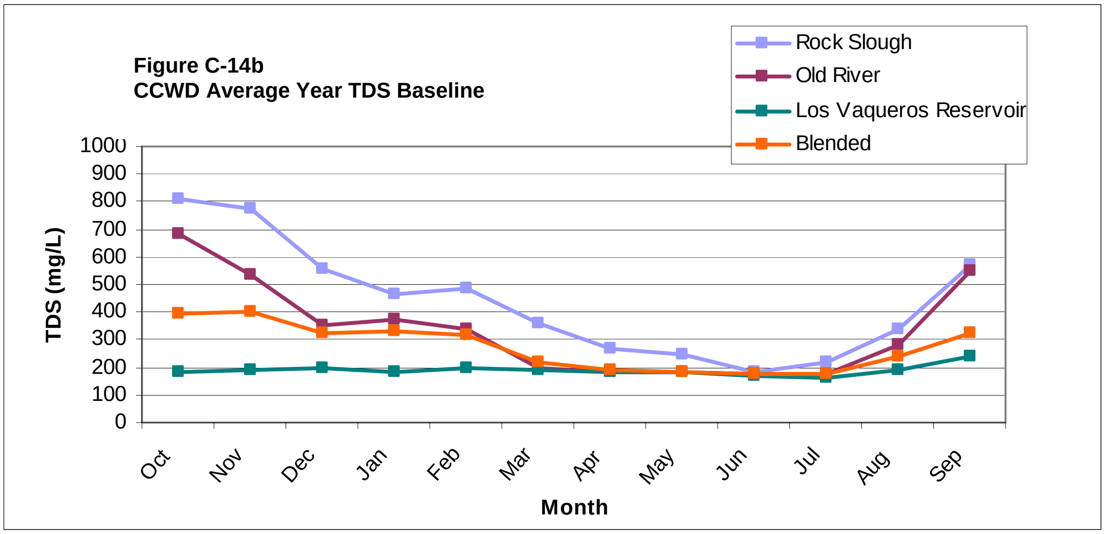
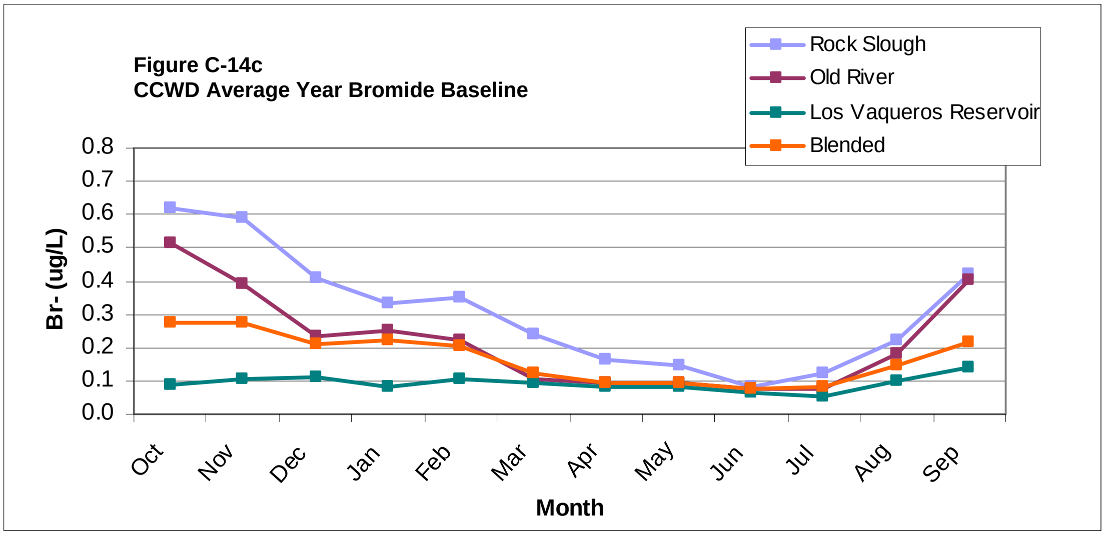


Figure C-14c
CCWD Average Year Bromide Baseline



3.4 East Bay Municipal Water District (EBMUD)

3.4.1 Water Supply Data and Baselines

This section provides a brief discussion of the water supply data that has been collected, as well as any historical anomalies that could lead to uncharacteristic data being included in the baseline.

Overview

Supplies

- Mokelumne Aqueduct Supplies
- Freeport Regional Water Project Supply
- Local surface water supplies - not included in this study

EBMUD receives supplies through the Mokelumne Aqueduct. Currently, water supply is derived entirely from the Mokelumne River watershed. The District has recently completed environmental documentation for the Freeport Regional Water Project that will allow the District to supplement flow to the Mokelumne Aqueduct in dry years from the Sacramento River, via the Folsom South Canal and new transmission facilities to be constructed by EBMUD. The supply baseline is intended to reflect year 2020 supplies. As a result, dry-year supply contributions from the Freeport Regional Water Project are also included in this baseline.

Projected year 2020 Mokelumne Aqueduct drafts from Pardee Reservoir were provided by EBMUD. In addition, the Freeport Regional Water Project Draft EIR/EIS of July, 2003, contains simulated EBMUD diversions at Freeport for a year 2020 level of development, for 1922 through 1993. The baseline supply will consist of the sum of the projected Mokelumne Aqueduct drafts from Pardee Reservoir and the FRWP EIR Freeport diversions to EBMUD to estimate total imported EBMUD year 2020 supply.

This flow data is reviewed below for the three hydrologic periods to be used, and is summarized in Table C-5.

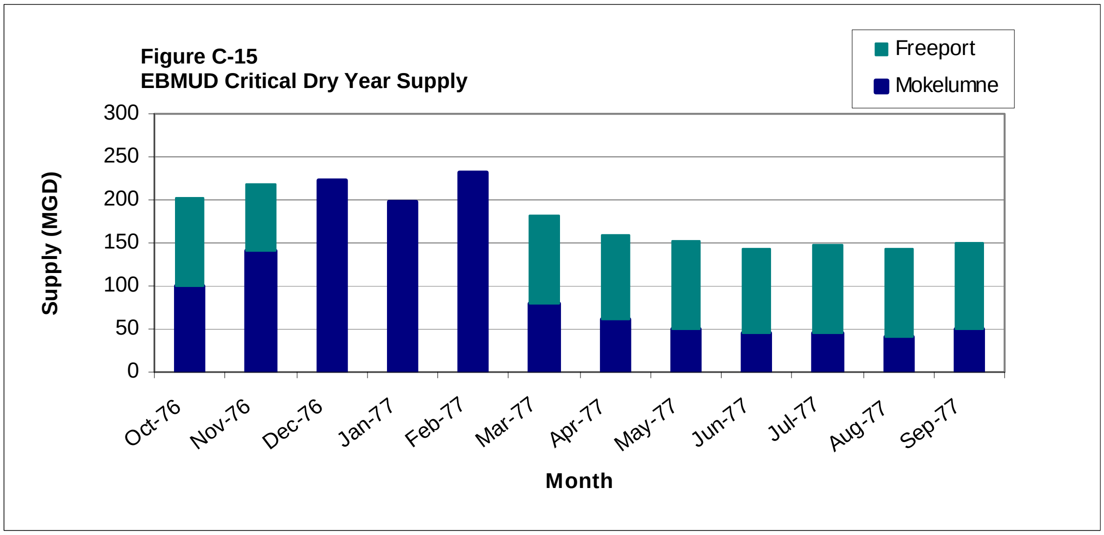
Table C-5
EBMUD Water Supply Baseline

Month	***Mokelumne***		***Freeport***			***Month***	***Mokelumne***		***Freeport***		
	Supply (MGD)	***%***	***Supply (MGD)***	***%***	***Total***		***Supply (MGD)***	***%***	***Supply (MGD)***	***%***	***Total***
Oct-1976	100.0	50%	101.7	50%	201.7	Oct-83	211.0	1.0	0.0	0.0	211.0
Nov-1976	140.0	64%	78.2	36%	218.2	Nov-83	228.0	1.0	0.0	0.0	228.0
Dec-1976	222.0	100%	0.0	0%	222.0	Dec-83	232.0	1.0	0.0	0.0	232.0
Jan-1977	197.0	100%	0.0	0%	197.0	Jan-84	232.0	1.0	0.0	0.0	232.0
Feb-1977	232.0	100%	0.0	0%	232.0	Feb-84	265.0	1.0	0.0	0.0	265.0
Mar-1977	80.0	44%	101.7	56%	181.7	Mar-84	218.0	1.0	0.0	0.0	218.0
Apr-1977	61.0	38%	98.5	62%	159.5	Apr-84	203.0	1.0	0.0	0.0	203.0
May-1977	50.0	33%	101.7	67%	151.7	May-84	226.0	1.0	0.0	0.0	226.0
Jun-1977	45.0	31%	98.5	69%	143.5	Jun-84	230.0	1.0	0.0	0.0	230.0
Jul-1977	45.0	31%	101.7	69%	146.7	Jul-84	234.0	1.0	0.0	0.0	234.0
Aug-1977	42.0	29%	101.7	71%	143.7	Aug-84	229.0	1.0	0.0	0.0	229.0
Sep-1977	51.0	34%	98.5	66%	149.5	Sep-84	230.0	1.0	0.0	0.0	230.0
WY Average	105	55%	74	45%	179	WY Average	228	100%	0	0%	228
WY Average (AFY)	118,090		82,350		200,430	WY Average (AFY)	255,590		0		255,590
Oct-1986	211.0	100%	0.0	0%	211.0	Oct-1989	185.0	100%	0.0	0%	185.0
Nov-1986	228.0	100%	0.0	0%	228.0	Nov-1989	205.0	100%	0.0	0%	205.0
Dec-1986	232.0	100%	0.0	0%	232.0	Dec-1989	210.0	100%	0.0	0%	210.0
Jan-1987	227.0	100%	0.0	0%	227.0	Jan-1990	209.0	100%	0.0	0%	209.0
Feb-1987	262.0	100%	0.0	0%	262.0	Feb-1990	245.0	100%	0.0	0%	245.0
Mar-1987	113.0	53%	101.7	47%	214.7	Mar-1990	93.0	48%	101.7	52%	194.7
Apr-1987	96.0	49%	98.5	51%	194.5	Apr-1990	75.0	43%	98.5	57%	173.5
May-1987	114.0	53%	101.7	47%	215.7	May-1990	77.0	43%	101.7	57%	178.7
Jun-1987	117.0	54%	98.5	46%	215.5	Jun-1990	75.0	43%	98.5	57%	173.5
Jul-1987	120.0	54%	101.7	46%	221.7	Jul-1990	76.0	43%	101.7	57%	177.7
Aug-1987	116.0	53%	101.7	47%	217.7	Aug-1990	73.0	42%	101.7	58%	174.7
Sep-1987	118.0	55%	98.5	45%	216.5	Sep-1990	79.0	45%	98.5	55%	177.5
Oct-1987	104.0	51%	101.7	49%	205.7	Oct-1990	176.0	95%	8.6	5%	184.6
Nov-1987	122.0	55%	98.5	45%	220.5	Nov-1990	203.0	100%	0.0	0%	203.0
Dec-1987	128.0	56%	101.7	44%	229.7	Dec-1990	208.0	100%	0.0	0%	208.0
Jan-1988	144.0	70%	62.1	30%	206.1	Jan-1991	203.0	100%	0.0	0%	203.0
Feb-1988	237.0	100%	0.0	0%	237.0	Feb-1991	238.0	100%	0.0	0%	238.0
Mar-1988	89.0	47%	101.7	53%	190.7	Mar-1991	87.0	46%	101.7	54%	188.7
Apr-1988	70.0	42%	98.5	58%	168.5	Apr-1991	68.0	41%	98.5	59%	166.5
May-1988	67.0	40%	101.7	60%	168.7	May-1991	63.0	38%	101.7	62%	164.7
Jun-1988	64.0	39%	98.5	61%	162.5	Jun-1991	59.0	37%	98.5	63%	157.5
Jul-1988	66.0	39%	101.7	61%	167.7	Jul-1991	60.0	37%	101.7	63%	161.7
Aug-1988	62.0	38%	101.7	62%	163.7	Aug-1991	57.0	36%	101.7	64%	158.7
Sep-1988	75.0	44%	94.2	56%	169.2	Sep-1991	65.0	40%	98.5	60%	163.5
Oct-1988	178.0	100%	0.0	0%	178.0	Oct-1991	75.0	42%	101.7	58%	176.7
Nov-1988	198.0	100%	0.0	0%	198.0	Nov-1991	163.0	83%	34.3	17%	197.3
Dec-1988	204.0	100%	0.0	0%	204.0	Dec-1991	202.0	100%	0.0	0%	202.0
Jan-1989	211.0	100%	0.0	0%	211.0	Jan-1992	201.0	100%	0.0	0%	201.0
Feb-1989	247.0	100%	0.0	0%	247.0	Feb-1992	234.0	100%	0.0	0%	234.0
Mar-1989	196.0	100%	0.0	0%	196.0	Mar-1992	85.0	46%	101.7	54%	186.7
Apr-1989	178.0	100%	0.0	0%	178.0	Apr-1992	66.0	40%	98.5	60%	164.5
May-1989	181.0	100%	0.0	0%	181.0	May-1992	145.0	91%	15.0	9%	160.0
Jun-1989	179.0	100%	0.0	0%	179.0	Jun-1992	156.0	100%	0.0	0%	156.0
Jul-1989	181.0	100%	0.0	0%	181.0	Jul-1992	157.0	100%	0.0	0%	157.0
Aug-1989	177.0	100%	0.0	0%	177.0	Aug-1992	153.0	100%	0.0	0%	153.0
Sep-1989	183.0	100%	0.0	0%	183.0	Sep-1992	161.0	100%	0.0	0%	161.0
WY Average							144		49		193
WY Average (AFY)							161,520		54,900		216,420

Critical Dry Year Analysis (WY and CY 1977)

Figure C-15 shows simulated critical year supply for EBMUD.

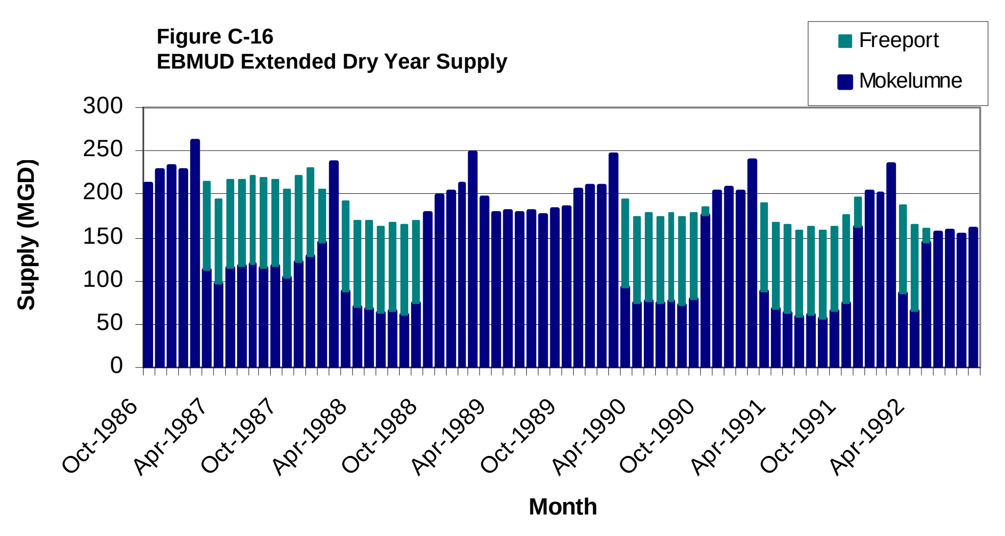
- Total imported supply is estimated to be 179 MGD (200,000 AFY), with 105 MGD (118,000 AFY) from the Mokelumne system and 74 MGD (82,000 AFY) through Freeport.



Extended Dry Year Analysis (WY 1987 - 1992)

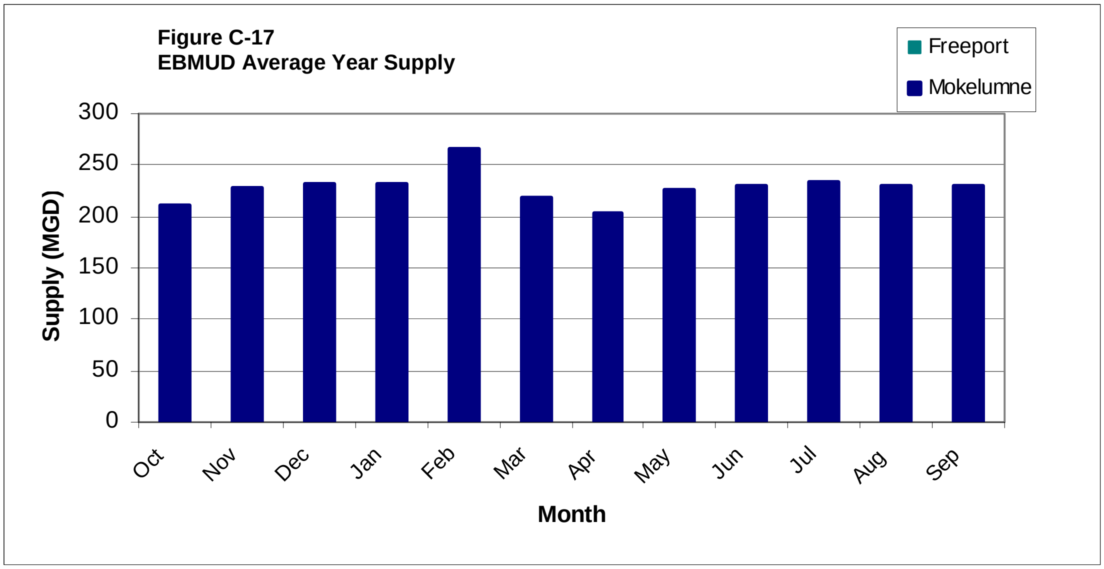
Figure C-16 shows simulated extended drought year supplies.

- Average agency imported supply is estimated to be 193 MGD (216,000 AFY), with 144 MGD (161,000 AFY) from the Mokelumne supply and 49 MGD (55,000 AFY) from the Freeport supply.



Average Year Analysis (WY 1984)

Figure C-17 shows average year supplies. Average agency imported supply is projected to be 228 MGD (256,000 AFY), all from the Mokelumne system.



3.4.2 Water Quality Data and Baselines

This section provides a brief discussion of the water quality data that has been collected, as well as methods implemented to fill in data gaps. In addition, any historical anomalies that could lead to uncharacteristic data being included in the baseline are identified.

Overview

EBMUD water supply sources and facilities are described in Section 3.4.1.

Water Quality Parameters

- **TOC** – monthly historical point concentrations have been compiled for the EBMUD Pardee Reservoir and Freeport supplies. This data will be used for quantitative water quality and treatment analysis.

- **TDS** – monthly historical point concentrations have been compiled for the EBMUD Pardee Reservoir supply, and simulated concentrations have been compiled for the Freeport supply. This data will be used for quantitative water quality and treatment analysis.

- **Bromide** - monthly historical point concentrations have been compiled for the EBMUD Pardee Reservoir supply, and simulated concentrations have been compiled for the Freeport supply. This data will be used for quantitative water quality and treatment analysis.

- **Temperature, pH** – data has been collected for the EBMUD supplies and will be used in a qualitative assessment. No formal baseline will be established for this data.

Historical monthly TOC, TDS and bromide data were collected for the years 1977 and 1987-1999, for the EBMUD Pardee Reservoir. Little data was available for these parameters for the late 1970s, with the majority of available data dating to the early 1990s and after. As a result, methods were employed to fill in gaps in the data sets. Data was averaged and interpolated, and maximum values of historical data were used where necessary.

Quarterly USGS monitoring data was available for the Sacramento River at Freeport for 1977. In addition, Greene's landing water quality data for 1985 through 1991 were provided by EBMUD. EBMUD Coordinated Monitoring Program (CMP) Freeport TOC and TDS data for years 2000 through 2003 were also provided.

The relationship:

- Bromide = 0.004 * Cl^- (14) where chloride and bromide are in mg/L

were used in developing the EBMUD water quality baseline for the Freeport supply, for which simulated chloride data was available and TDS and bromide data were limited.

Table C-6 summarizes the data sources for each hydrologic period.

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[14] Mean chloride – bromide relationship reported in the Alternate Source Study – Greene's Landing for April 1985 through April 1991 data.

Table C-6
EBMUD Water Quality Data Sources

	Critical (1977)		***Extended Dry (1987-1992)***		***Average Year***	
	Mokelumne	***Freeport***	***Mokelumne***	***Freeport***	***Mokelumne***	***Freeport***
TOC	Estimated as max monthly values from 1987-1992	Quarterly USGS data (Sacramento River at Freeport), used max values of Greene's landing data for missing values)	Historical Pardee Reservoir data	Greene's Landing data	Average of 1997-1999 data	CMP Freeport Data from 1993-2003
TDS	Estimated as max monthly values from 1987-1992	Max values from Greene's Landing data	Historical Pardee Reservoir data	Greene's Landing data (1992 values are monthly averages of 1987-1991 data)	Average of 1997-1999 data	CMP Freeport Data from 2000-2003
Bromide	Estimated as max monthly values from 1987-1992	Greene's Landing data 1987-1992 max values, omit outliers, maximum of 0.03 mg/L and non-detect = 0.5*detection limit	Historical Pardee Reservoir data	Greene's Landing data, non-detect = 0.5*detection limit	Average of 1997-1999 data	0.5*reporting limit (0.0065 mg/L) for all months (EBMUD monitoring: all 2002-2003 samples below detection)

Critical Dry Year Analysis

Figures C-18a, C-18b and C-18c show the critical year baseline values for TOC, TDS and bromide by source.

- Only Delta water chloride data was available for the Mokelumne Aqueduct for 1977, which is not representative of the water quality of traditional Mokelumne supply. To estimate the Pardee Reservoir TDS, TOC, and bromide experienced in critical years in the absence of historical data, we used the maximum historical data values for each month over the months and years for which there was historical data available.

- The USGS water quality database contains quarterly historical TOC data for the Sacramento River at Freeport[15]. Missing months were estimated by taking maximum monthly values from Greene's Landing data for 1987 through 1991. Maximum monthly Greene's Landing TDS values for 1987 through 1991 were used to estimate critical year monthly TDS. Bromide was converted from chloride projections using the relationship described above.

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[15] USGS Station 11447650 Sacramento River at Freeport.

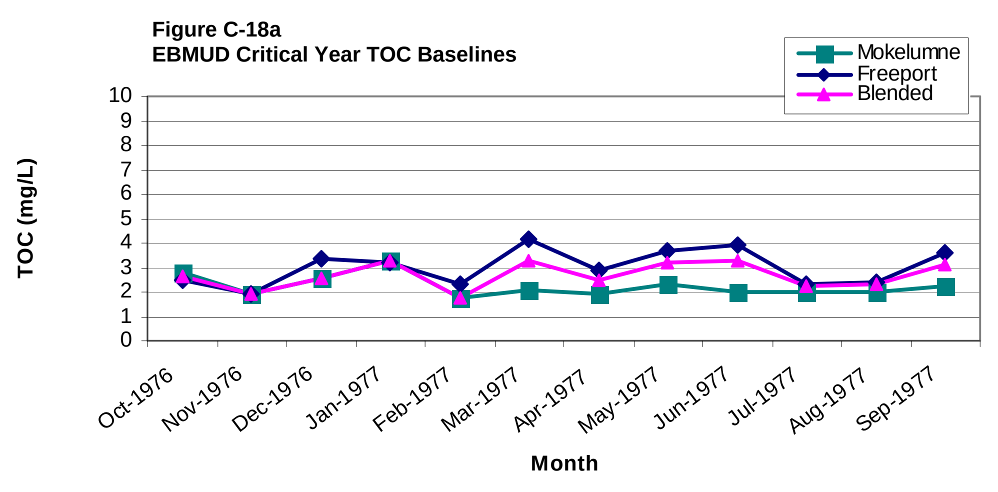


Figure C-18a
EBMUD Critical Year TOC Baselines

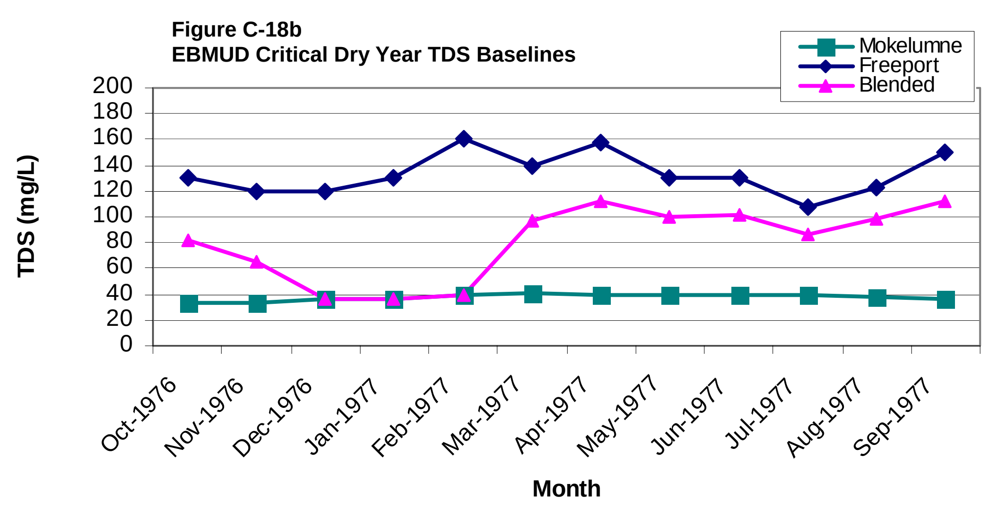


Figure C-18b
EBMUD Critical Dry Year TDS Baselines

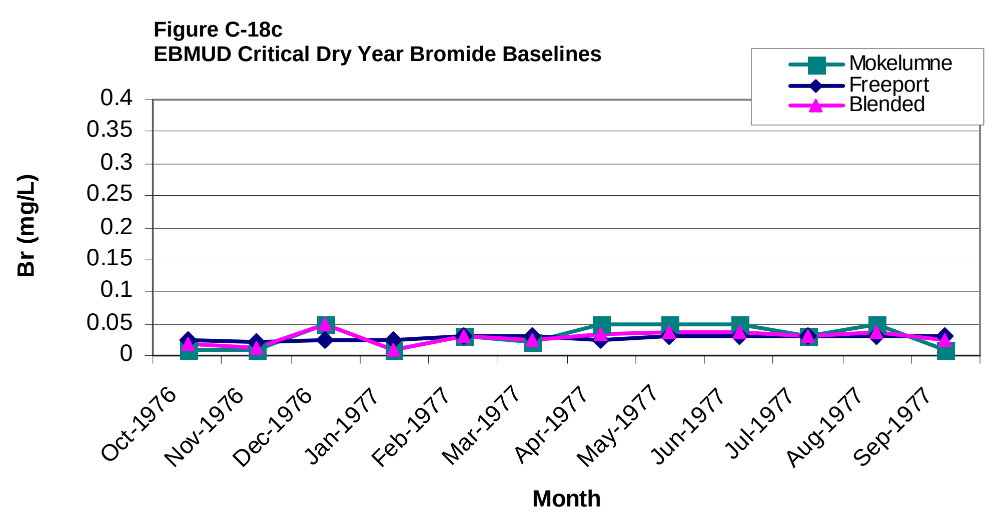
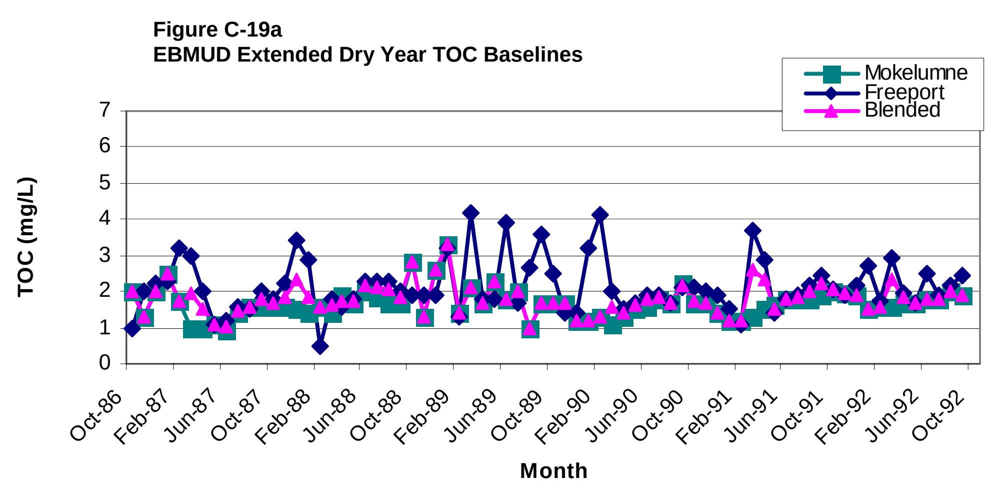


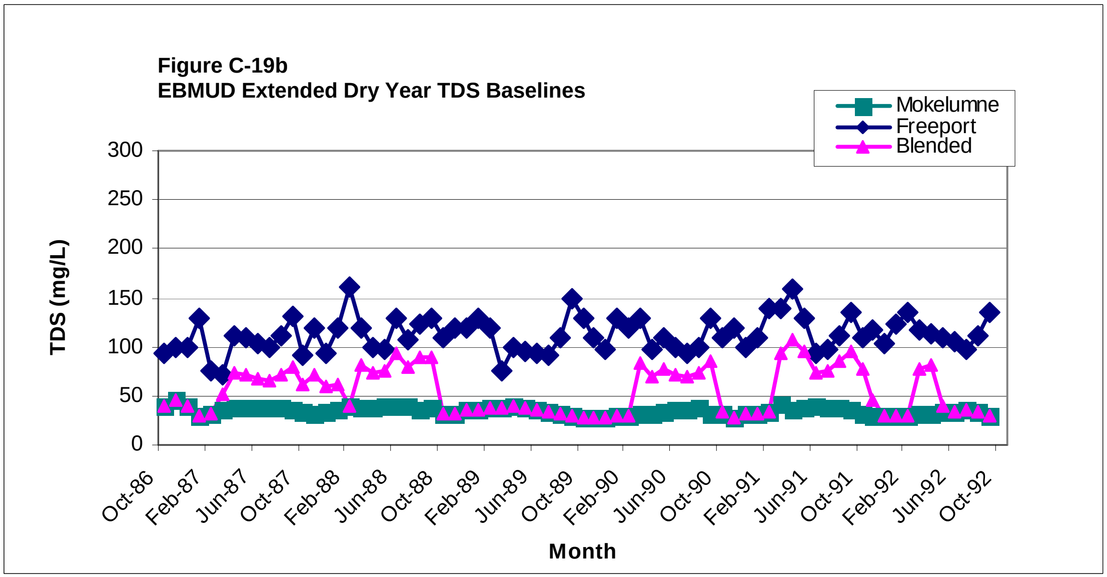
Figure C-18c
EBMUD Critical Dry Year Bromide Baselines

Extended Dry Year Analysis

Figures C-19a, C-19b, and C-19c show the extended dry year baseline values for TOC, TDS and bromide by source.

- The Mokelumne Aqueduct baselines were established using historical Pardee Reservoir water quality data collected from 1987 – 1992. Reported Pardee Reservoir bromide values for February and March of 1992 were two orders of magnitude greater than the January and April values of the same year, and were considered outliers. They were replaced by interpolating between January and March values.
- Monthly Greene's Landing TOC, TDS and bromide data for 1987 through 1991 was used for those years. 1992 monthly values were estimated by averaging the 1987 through 1991 values by month.





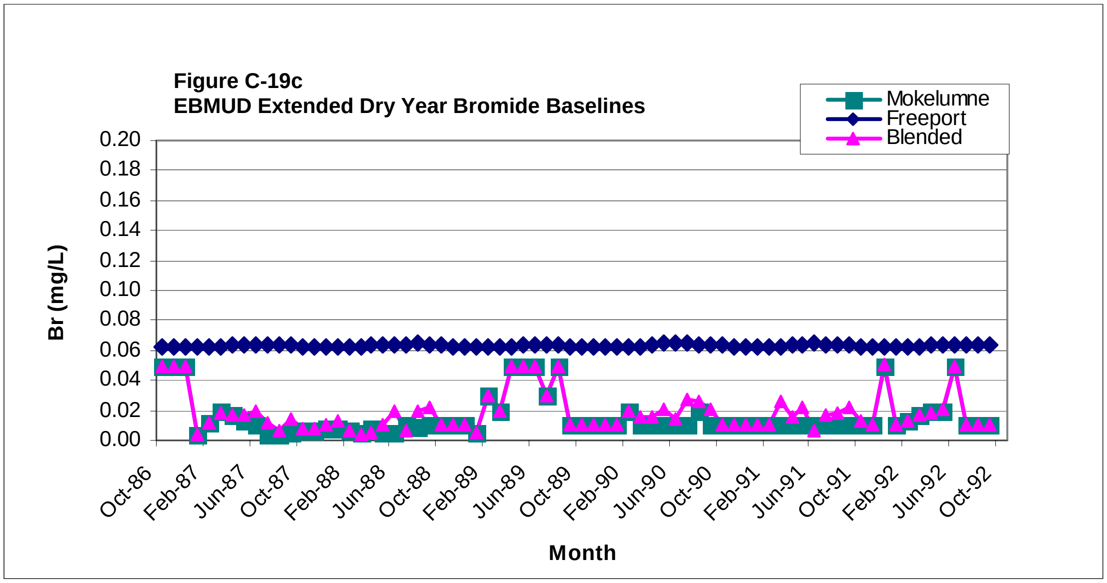


Figure C-19c
EBMUD Extended Dry Year Bromide Baselines

Average Hydrologic Year Analysis

Figure C-20a, C-20b and C-20c show the average year baseline values for each constituent and source.

- Due to the limited average year variability of EBMUD water quality, we estimated the Pardee Reservoir water quality experienced in average years by averaging the available non-drought year historical data (1997 – 1999). The November, 1998 bromide value was four times all other values for that year, and was determined to be an outlier. It was replaced with the average value of the October and December data points for that year.
- CMP Freeport TOC and TDS data were available for 2000 through 2003. This data was averaged by month to estimate average year monthly TOC and TDS values, respectively. For 2002 and 2003, EBMUD monitoring data found all bromide samples to be below the reporting limit of 0.013 mg/L. As a result, these months were estimated as half of the reporting limit, or 0.0065 mg/L. While the Freeport supply is not part of the EBMUD average year supply, this data will be used in evaluating the Bay Area Use of the Freeport Regional Water Project concept[16].

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[16] Note: Freeport water will not be used by EBMUD in average years. However, this baseline will be used to developing the water quality baseline for the Bay Area Use of the Freeport Regional Water Project concept. The average year baseline presented here represents source water quality and does not reflect changes in water quality constituents resulting from treatment at the Walnut Creek Water Treatment Plant (15% reduction in TOC, conversion of bromide to brominated disinfection by-products, negligible change in TDS).

Figure C-20a
EBMUD Average Year TOC Baseline

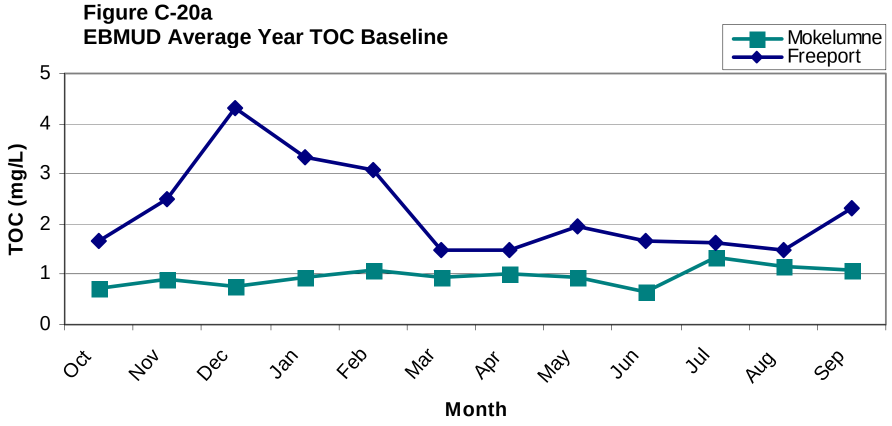


Figure C-20b
EBMUD Average Year TDS Baseline

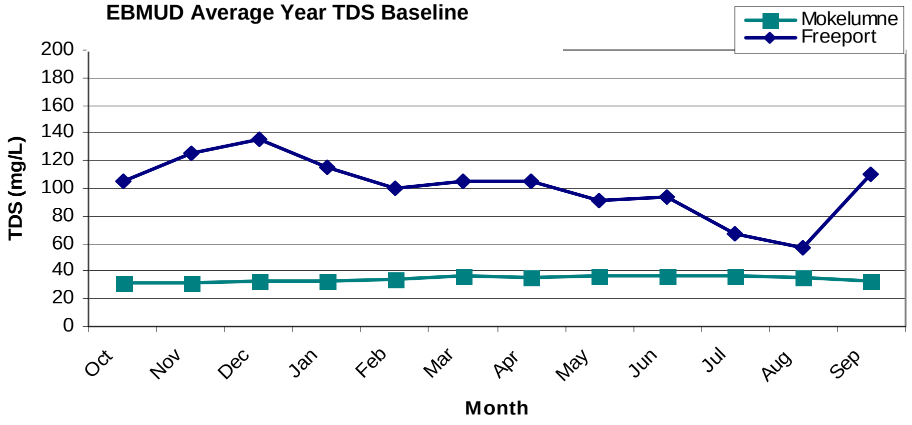
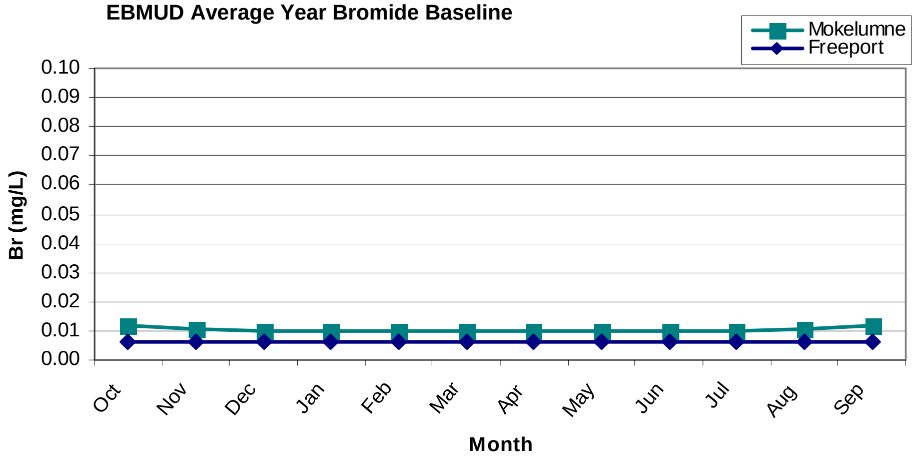


Figure C-20c
EBMUD Average Year Bromide Baseline



Figures C-21a, C-21b and C-21c summarize the blended[17] water quality baselines for EBMUD. The baselines presented in these graphs represent the projected mixture of Mokelumne and Freeport supplies under the three different hydrologic conditions[18].

Figure C-21a
EBMUD Blended Baseline TOC Concentrations

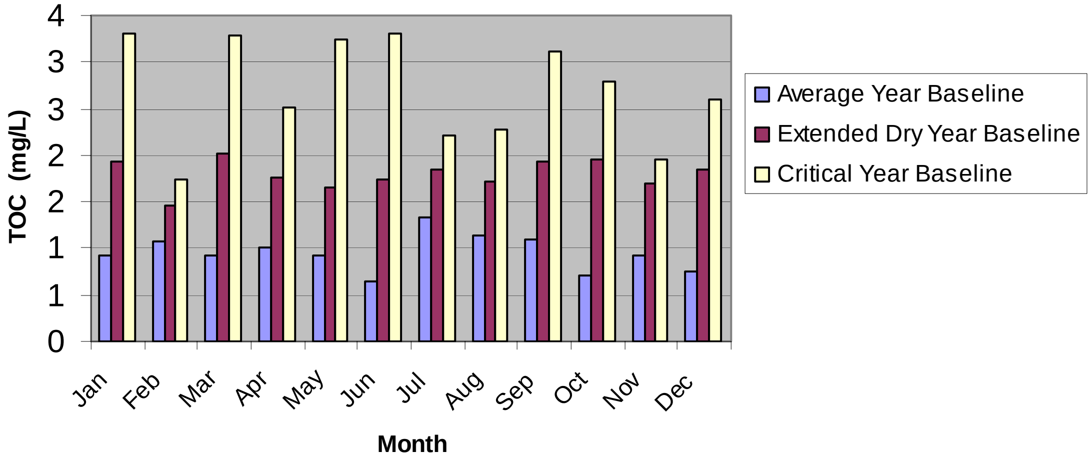
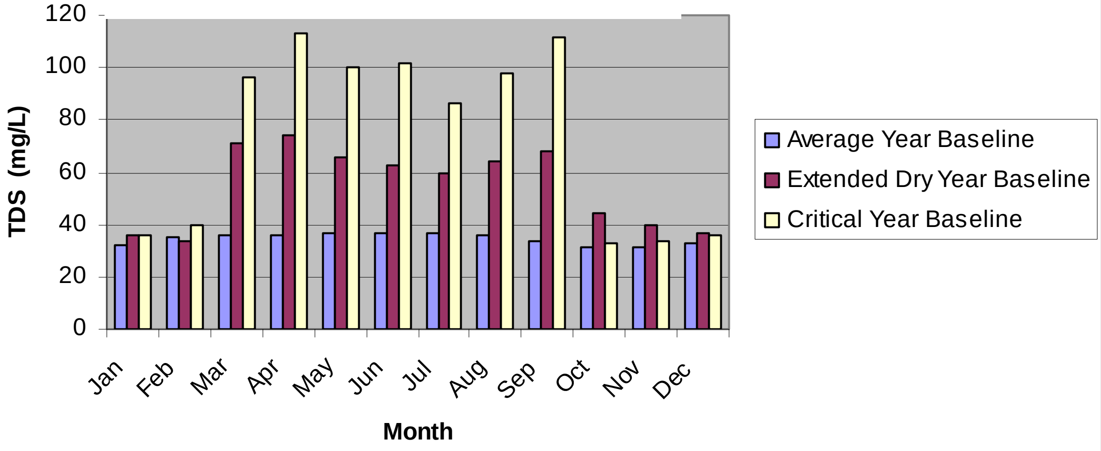


Figure C-21b
EBMUD Blended Baseline TDS Concentrations



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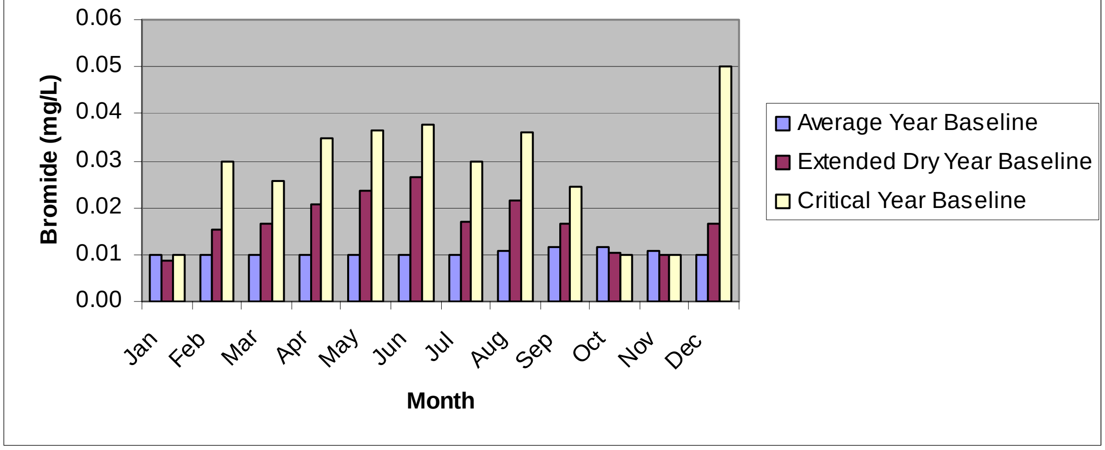
[17] The Freeport Regional Water Project is evaluating different alternatives for using the future Freeport supply, and may not blend the Freeport supply with Mokelumne Aqueduct supplies. For the purpose of this study, we are assuming that Mokelumne and Freeport source waters will be blended.

[18] The blended average year baseline will be identical to the average year Mokelumne baseline, as no supply will be conveyed through Freeport in average years.

Figure C-21c
EBMUD Blended Baseline Bromide Concentrations



3.5 Santa Clara Valley Water District (SCVWD)

3.5.1 Water Supply Data and Baselines

This section provides a brief discussion of the water supply data that has been collected, as well as any historical anomalies that could lead to uncharacteristic data being included in the baseline.

Overview

Supplies

- State Water Project (SWP) Supplies
- Central Valley Project (CVP) Supplies – not included in this study
- Local groundwater supplies - not included in this study

SCVWD receives imported supplies from the State Water Project (SWP) via the South Bay Aqueduct (SBA) and from the Central Valley Project (CVP). The SCVWD supply baseline for SWP deliveries was developed using simulated data developed by SCVWD for use by the Expanded Los Vaqueros studies team. These deliveries use the CALFED Common Assumptions Working Group OCAP Study 4[19].

None of the concepts or example portfolios retained for detailed analysis in Phase 2 of the BAWQ&SR Program will affect the quantity or quality of the CVP supply. As such, no water supply or quality baselines have been developed for that supply.

This flow data is reviewed below for the three hydrologic periods to be used, and is summarized in Table C-7.

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[19] This simulation includes 2020 level of development and hydrology, Central Valley Improvement Act 3406(b)2 provisions, South Delta Improvements, Freeport Regional Water Project, and H.O. Banks Pumping Plant at 8,500 cfs capacity. The Expanded Los Vaqueros Reservoir study team used this run as a basis for Expanded Los Vaqueros Reservoir operations, and included operations for the Environmental Water Account.

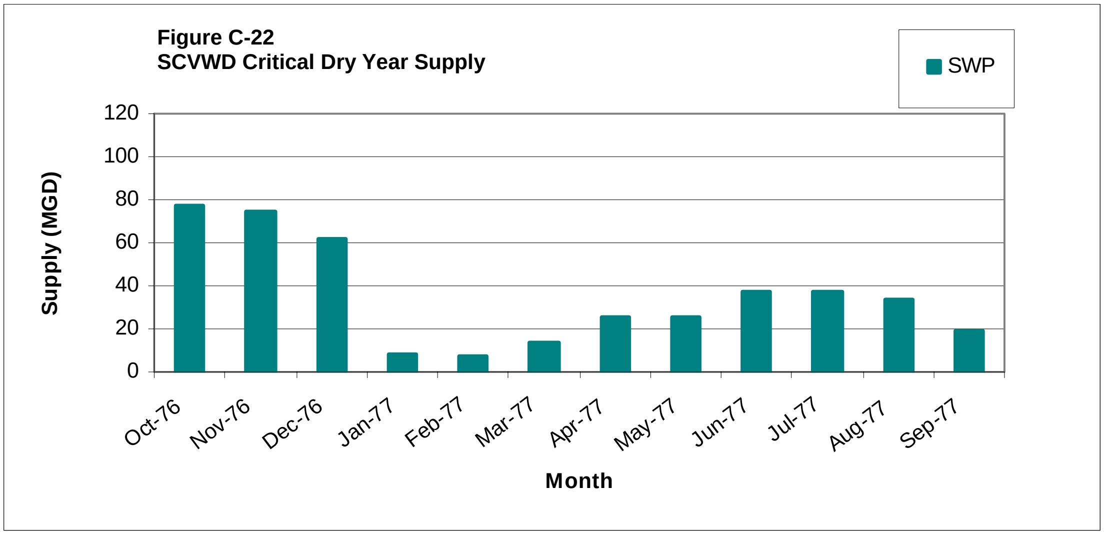
Table C-7
SCVWD Water Supply Baseline (MGD)

Month	***SWP Supply***	***Month***	***SWP Supply***
Critical Dry Year		**Average Year**	
Oct-76	77.5	Oct (Average Year)	82.0
Nov-76	74.2	Nov (Average Year)	83.2
Dec-76	62.2	Dec (Average Year)	71.3
Jan-77	7.9	Jan (Average Year)	93.3
Feb-77	7.5	Feb (Average Year)	92.6
Mar-77	14.0	Mar (Average Year)	66.2
Apr-77	25.6	Apr (Average Year)	86.2
May-77	25.2	May (Average Year)	90.7
Jun-77	37.5	Jun (Average Year)	99.1
Jul-77	37.0	Jul (Average Year)	98.2
Aug-77	33.8	Aug (Average Year)	92.6
Sep-77	19.2	Sep (Average Year)	92.4
WY Average	35	WY Average	87
WY Average (AFY)	39,370	WY Average (AFY)	97,800
Extended Dry Year			
Oct-1987	64.8	Oct-1989	77.8
Nov-1987	67.2	Nov-1989	84.3
Dec-1987	58.0	Dec-1989	73.8
Jan-1987	74.1	Jan-1990	34.8
Feb-1987	73.4	Feb-1990	34.3
Mar-1987	57.0	Mar-1990	26.7
Apr-1987	77.2	Apr-1990	42.6
May-1987	92.1	May-1990	66.0
Jun-1987	100.6	Jun-1990	66.3
Jul-1987	99.7	Jul-1990	65.6
Aug-1987	94.1	Aug-1990	61.2
Sep-1987	83.5	Sep-1990	41.2
Oct-1987	77.5	Oct-1990	36.5
Nov-1987	73.3	Nov-1990	27.8
Dec-1987	61.2	Dec-1990	18.3
Jan-1988	27.4	Jan-1991	30.8
Feb-1988	27.0	Feb-1991	30.3
Mar-1988	21.0	Mar-1991	23.9
Apr-1988	33.5	Apr-1991	38.0
May-1988	51.9	May-1991	58.7
Jun-1988	52.2	Jun-1991	59.3
Jul-1988	51.6	Jul-1991	58.7
Aug-1988	48.1	Aug-1991	54.8
Sep-1988	32.4	Sep-1991	37.1
Oct-1988	28.7	Oct-1991	32.9
Nov-1988	21.9	Nov-1991	24.9
Dec-1988	14.4	Dec-1991	16.5
Jan-1989	85.1	Jan-1992	32.8
Feb-1989	84.5	Feb-1992	32.3
Mar-1989	59.9	Mar-1992	36.4
Apr-1989	77.6	Apr-1992	51.5
May-1989	80.4	May-1992	73.5
Jun-1989	87.8	Jun-1992	85.1
Jul-1989	87.0	Jul-1992	84.4
Aug-1989	82.1	Aug-1992	80.3
Sep-1989	83.1	Sep-1992	61.4
WY Average			56.3
WY Average (AFY)			63,040

Critical Dry Year Analysis (WY 1977)

Figure C-22 shows critical year imported SWP supplies for SCVWD.

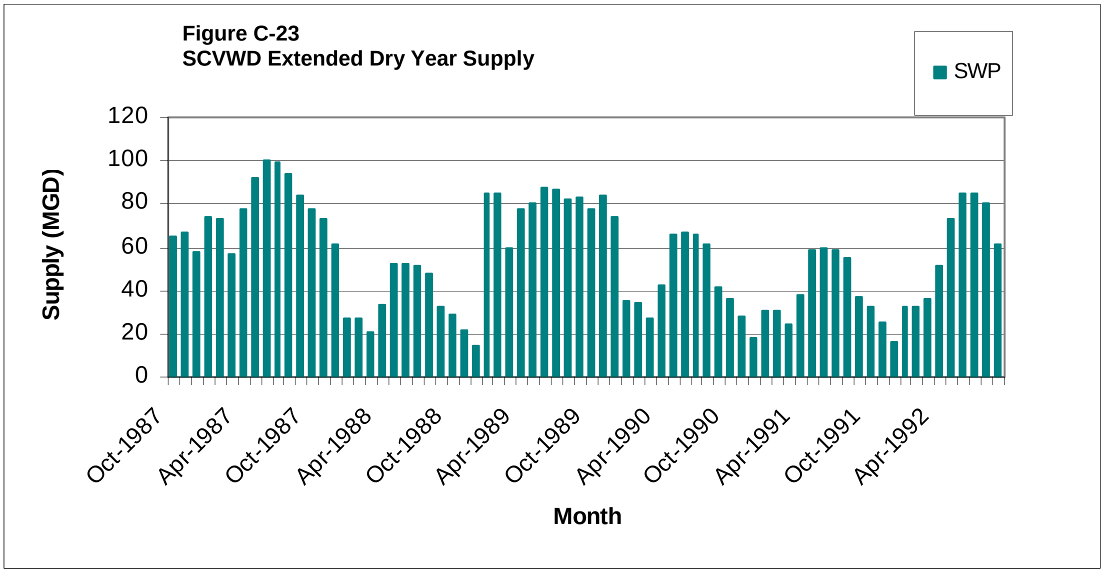
- Total critical year SCVWD SWP supply is projected to be 35 MGD (40,000 AFY).



Extended Dry Year Analysis (WY 1987 - 1992)

Figure C-23 shows drought year supplies.

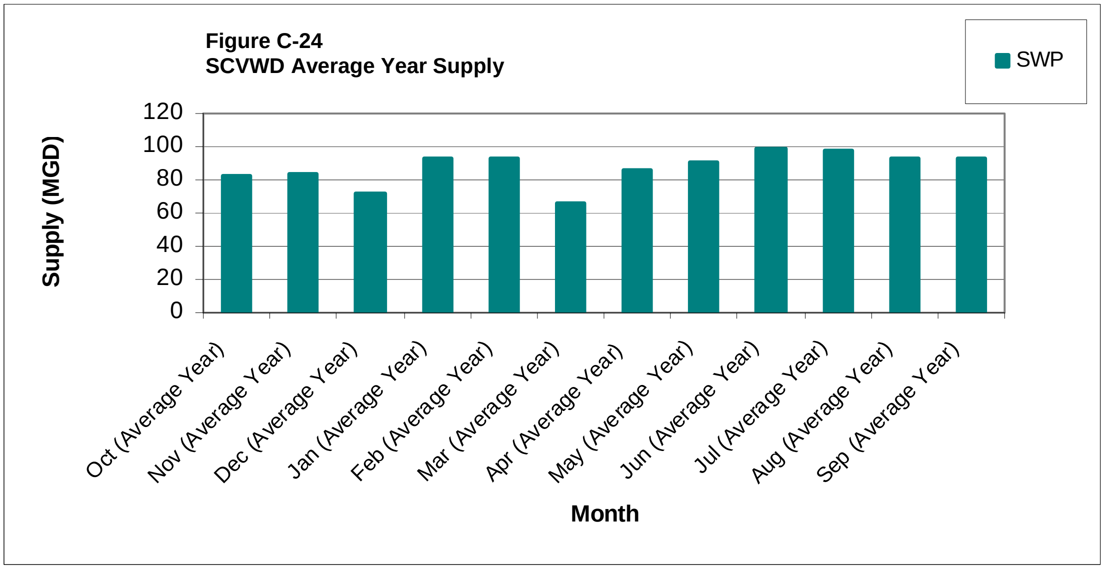
- Average extended dry year SCVWD SWP supply is projected to be 56 MGD (63,000 AFY).



Average Year Analysis (1984)

Figure C-24 shows average year supplies.

- Average year SCVWD SWP supply is projected to be 87 MGD (98,000 AFY).



3.5.2 Water Quality Data and Baselines

This section provides a brief discussion of the water quality data that has been collected, as well as methods implemented to fill in data gaps. In addition, any historical anomalies that could lead to uncharacteristic data being included in the baseline are identified.

Overview

SCVWD water supply sources and facilities are described in section 3.5.1.

Water Quality Parameters

- **TOC** – monthly blended point concentrations have been compiled. This data will be used for quantitative water quality and treatment analysis.
- **TDS** – monthly simulated SWP chloride data was converted to TDS. This data will be used for quantitative water quality and treatment analysis.
- **Bromide** - monthly simulated SWP chloride data was converted to bromide. This data will be used for quantitative water quality and treatment analysis.
- **Temperature, pH** – data has been collected for the SWP supply and will be used in a qualitative assessment. No formal baseline will be established for this data.

Simulated bromide and TDS were calculated from simulated chloride data for the Clifton Court Forebay.

Harvey O. Banks Pumping Plant dissolved organic carbon (DOC) data was collected from 1986 through 1997. This data was used as a surrogate for 1987 through 1992 extended dry year TOC data. In addition, Banks 1990 through 1997 DOC data was averaged by month to obtain monthly TOC concentrations for the average hydrology baseline. Maximum monthly values taken over the extended dry period (1987 through 1992) were used to estimate critical dry year (1977) TOC concentrations.

A SWP water quality baseline was developed from the water quality estimates for SWP deliveries developed by the CALFED Los Vaqueros Studies (using DSM II) in conjunction with historical DOC data, as described above.

Critical Dry Year Analysis

- Figures C-25a through C-25c show the critical year baseline values for TOC, TDS and bromide by source, on a calendar year and water year basis, with 1977 being taken as critical year hydrology.

Figure C-25a
SWP Critical Dry Year TOC Baseline

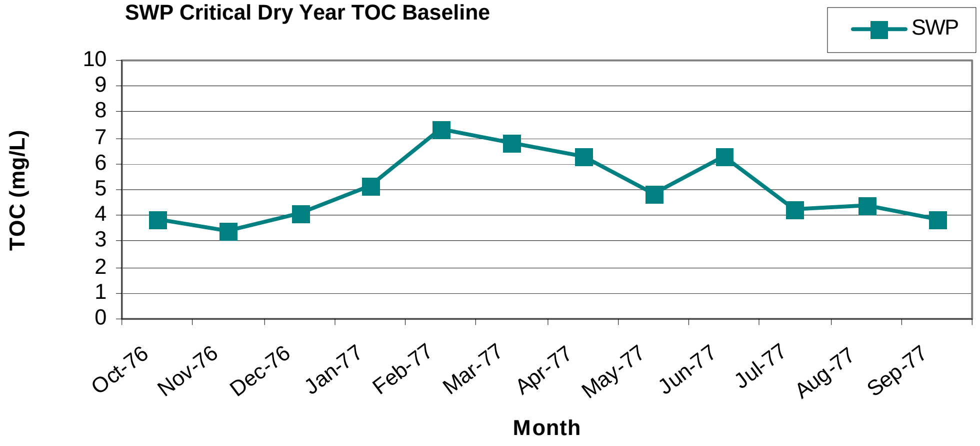


Figure C-25b
SWP Critical Dry Year TDS Baseline

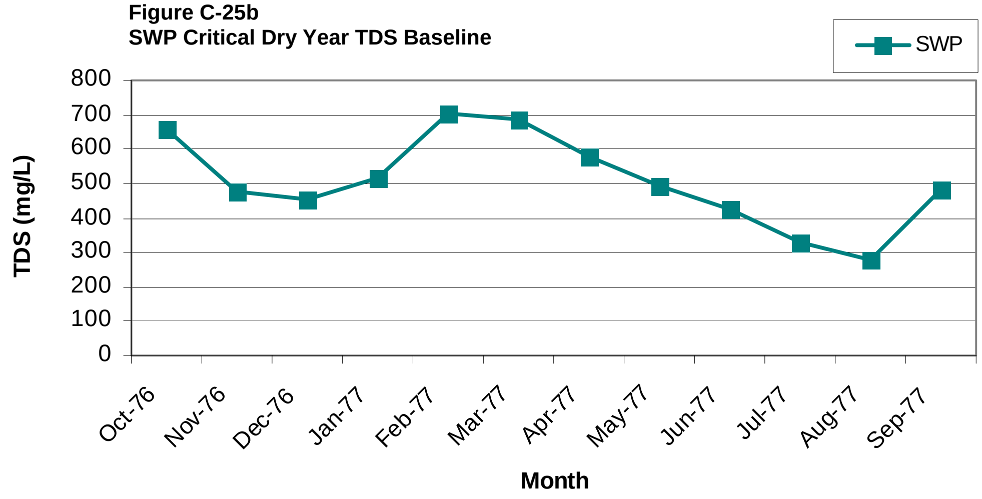
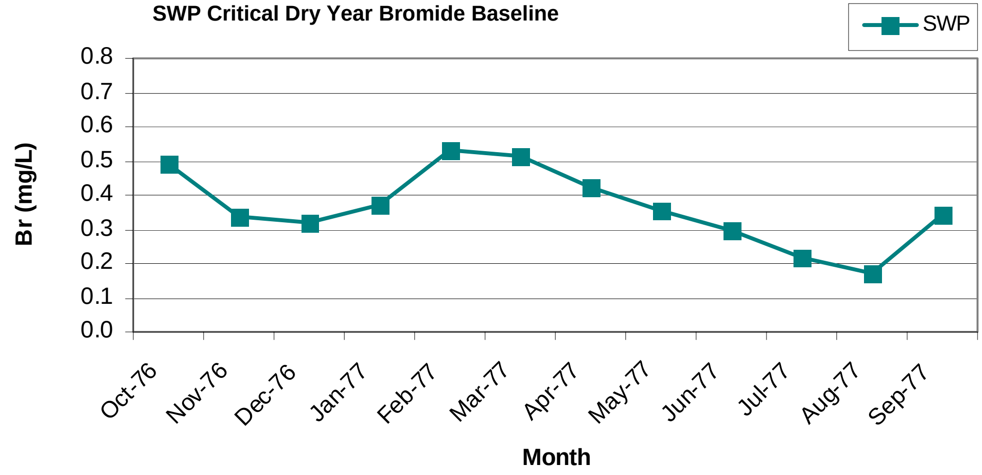


Figure C-25c
SWP Critical Dry Year Bromide Baseline



Extended Dry Year Analysis

- Figures C-26a, C-26b, and C-26c show the extended dry year baseline values for TOC, TDS and bromide by source, with water years 1987 through 1992 being taken as critical year hydrology.

Figure C-26a
SWP Extended Dry Year TOC Baseline

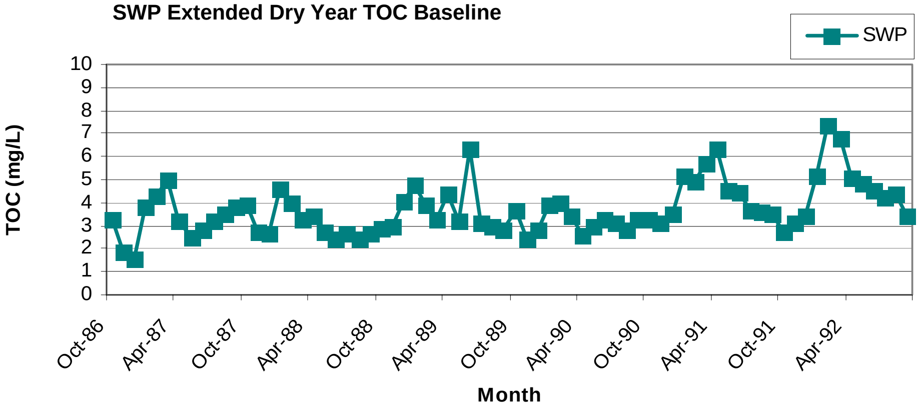


Figure C-26b
SWP Extended Dry Year TDS Baseline

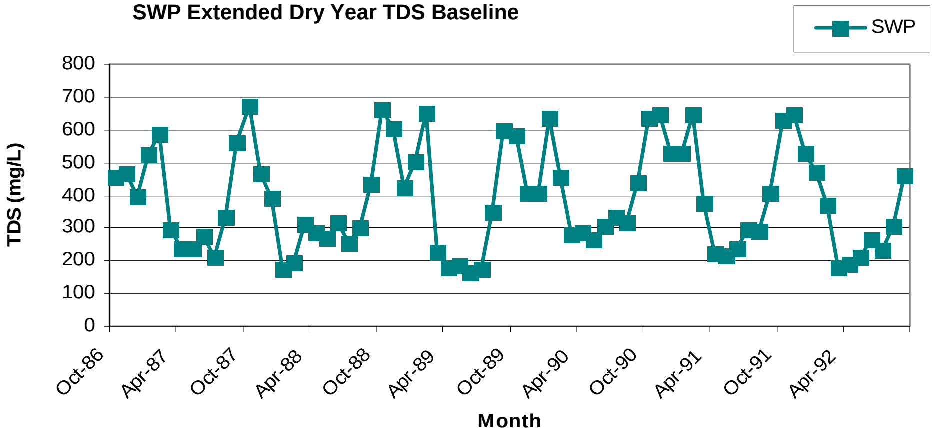
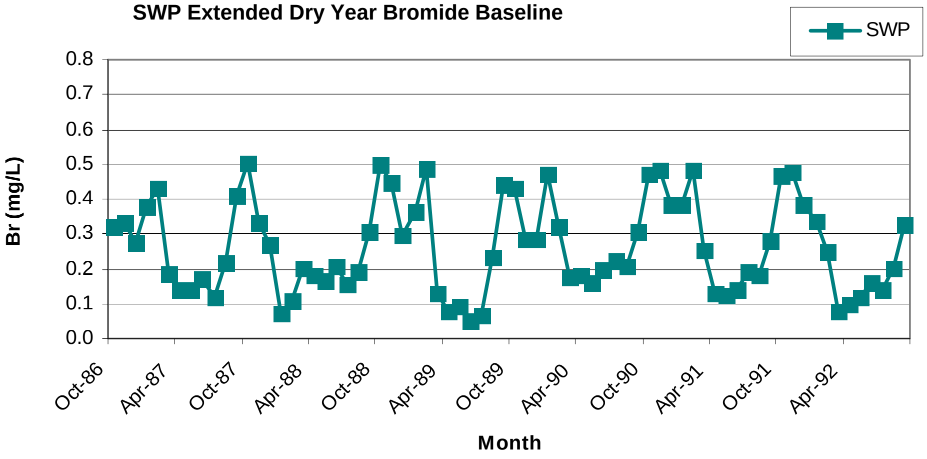


Figure C-26c
SWP Extended Dry Year Bromide Baseline



Average Hydrologic Year Analysis

- Figure C-27a, C-27b and C-27c show the average year baseline values for each constituent and source. Long term averages were used for SWP average year hydrology.

Figure C-27a
SWP Average Year TOC Baseline

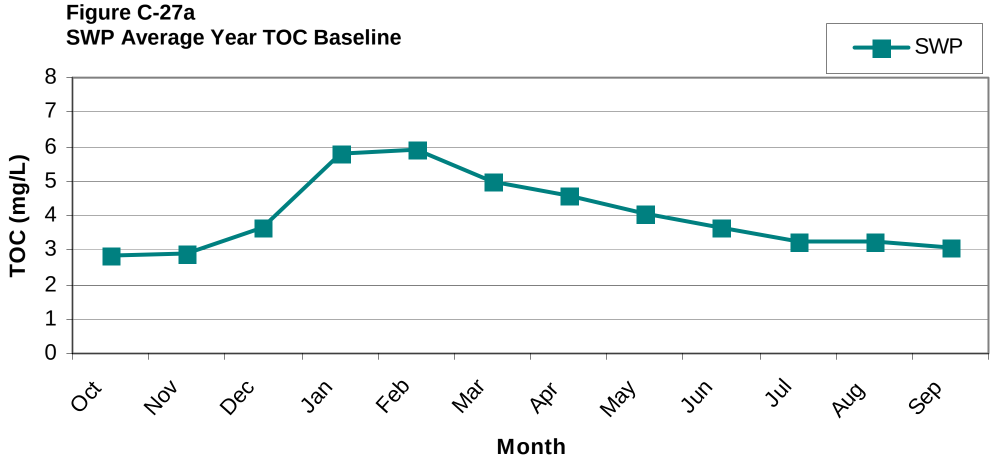


Figure C-27b
SWP Average Year TDS Baseline

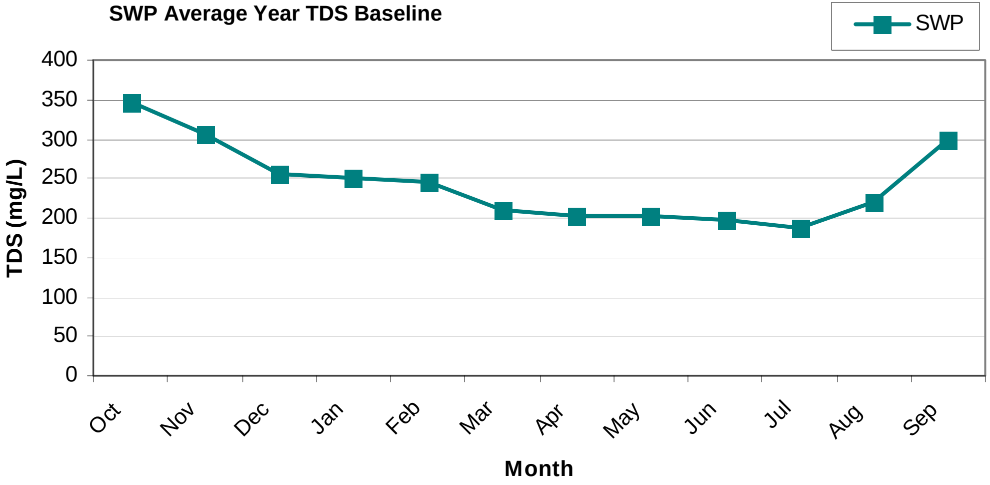
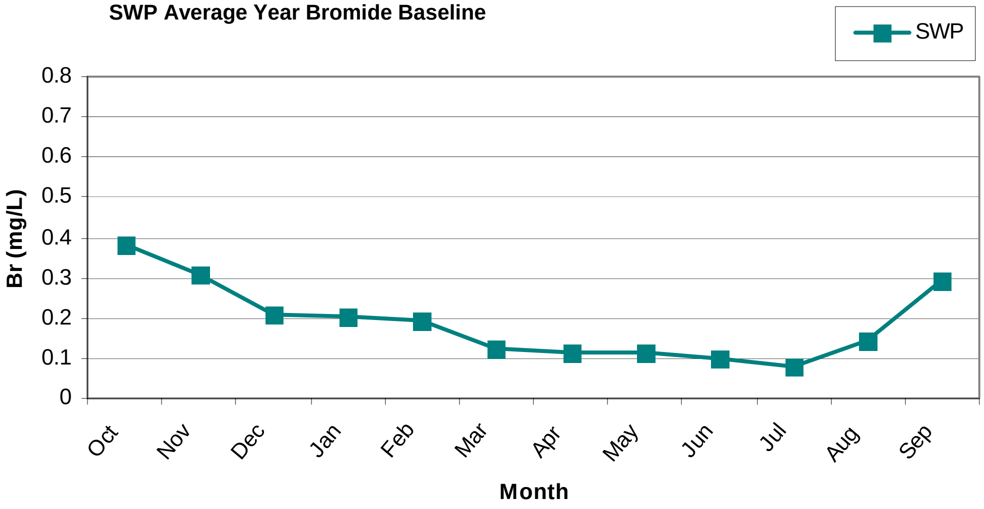


Figure C-27c
SWP Average Year Bromide Baseline



3.6 San Francisco Public Utilities Commission (SFPUC)

3.6.1 Water Supply Data and Baselines

This section provides a brief discussion of the water supply data that has been collected, as well as any historical anomalies that could lead to uncharacteristic data being included in the baseline.

Overview

Supplies

- Hetch Hetchy Aqueduct Supply
- East Bay Supplies (Calaveras and San Antonio Reservoirs)
- Peninsula Supplies (Crystal Springs, Pilarcitos and San Andreas Reservoirs)

For the SFPUC System, both water supply and water quality changes are estimated as water is conveyed into the Bay Division Pipelines (BDPLs). Water supply is also estimated for the Peninsula system. The Peninsula supply is estimated as a single reservoir receiving local inflow and Hetch Hetchy Aqueduct transfers. Water quality changes associated with the Peninsula system are not explicitly modeled, as it has been assumed that any transfer of water into the SFPUC system would occur in the East Bay reservoirs or at the BDPLs.

Monthly water supply and consumption reports for SFPUC dating from 1962 through 1998 were obtained. These reports, prepared by Water Supply & Treatment Division, summarize monthly demands, supplies, and reservoir levels, and compare current month conditions with the past year. These reports were replaced with daily reports after 1998.

This historical data was used to develop baseline supply conditions for dry years. At the request of SFPUC, historical Hetch Hetchy Aqueduct deliveries for 1977 and 1987 through 1992 were adjusted to remove deliveries from Lake Lloyd and Lake Eleanor via the Lower Cherry Aqueduct because these sources are not part of SFPUC's permitted unfiltered supply, and their future use during droughts is uncertain. Historical data were also adjusted to remove transfers from the South Bay Aqueduct to San Antonio Reservoir during the 1987 through 1992 drought.

SFPUC projects an increase in demands for the year 2020. In critical years and extended drought conditions, the SFPUC supply will reflect similar limitations as it has in past years. As such, historical deliveries for 1977 and 1987 through 1992 were used to estimate future supply in critical dry years and extended drought conditions, respectively. However, in average years it is assumed that the SFPUC system will meet projected demands. We have used historical monthly demands for the years 1994 through 1998 to develop a demand distribution for average years. This distribution was applied to projected average annual demand[20] to determine projected monthly demands. SFPUC supplies were adjusted to meet the projected demands by increasing Hetch Hetchy Aqueduct deliveries while maintaining delivery constraints (e.g., 300 MGD). In addition, transfers to San Antonio Reservoir were reduced, and local reservoir operations were modified such that no net drafts occur from storage over the year.

For the purposes of this analysis, the Peninsula Reservoirs are included in the supply analysis only. Water quality is estimated at the Bay Division Pipelines' connection to the Irvington Tunnel. It is assumed that any transfer of water evaluated by this study would occur in the East Bay reservoirs or at the Bay Division Pipelines.

This flow data is reviewed below for the three hydrologic periods to be used, and is summarized in Table C-8.

Critical Dry Year Analysis (1977)

Figure C-28 shows critical year supplies.

- In 1977, Crystal Springs draft is greater than San Andreas Reservoir input, suggesting that direct deliveries were made from Crystal Springs Reservoir to the system. San Andreas Reservoir input and drafts balance, so Peninsula drafts presented here are total Crystal Springs Reservoir deliveries. Local East Bay and Peninsula supplies were negligible.
- Lake Lloyd and Lake Eleanor deliveries to Hetch Hetchy Aqueduct via the Lower Cherry Aqueduct were removed from historical Hetch Hetchy Aqueduct deliveries because these are not part of the permitted unfiltered supply.
- On a water year basis, total SFPUC system supply is projected to be 140 MGD (157,000 AFY). Hetch Hetchy Aqueduct supplies are estimated to be 147 MGD (165,000 AFY). Calaveras Reservoir drafts are projected to average 0.1 MGD, or 100 AFY, and San Antonio Reservoir drafts are projected to average 9 MGD (10,000 AFY). Peninsula drafts are projected to be 72 MGD (80,000 AFY). Critical year supply is comprised entirely of Hetch Hetchy transfers. Local inflow to all reservoirs was negligible.

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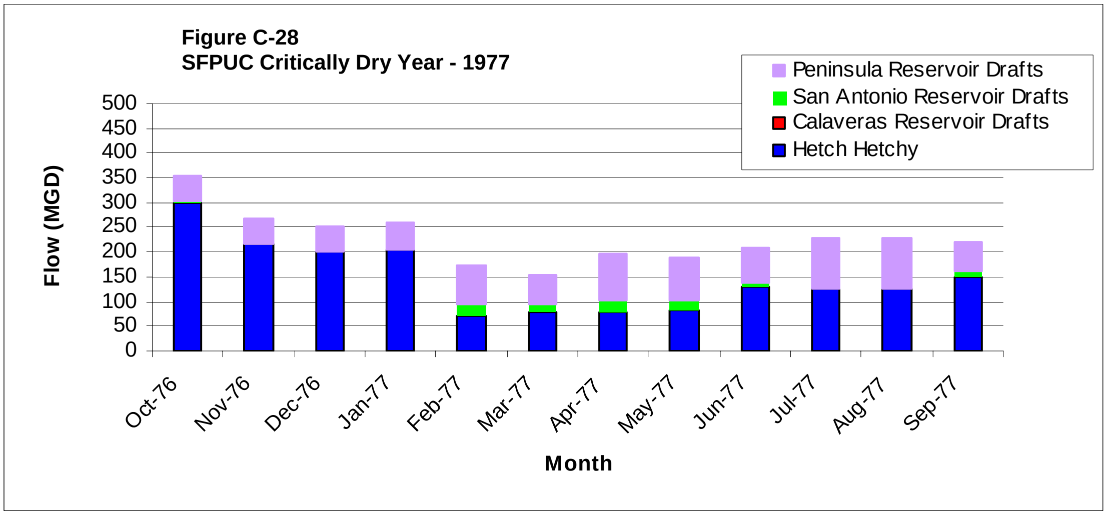
[20] For more information on SFPUC future demand assumptions, please refer to the BAWQ&SRP Water Demand Projections Technical Memorandum.

Table C-8
Historical SFPUC Monthly Drafts Data
Hetch Hetchy, San Antonio and Calaveras Reservoirs (MGD)

Month	*Flow (MGD)*					*Month*	*Flow (MGD)*				
	Hetch Hetchy	*Calaveras Reservoir Drafts*	*San Antonio Reservoir Drafts*	*Peninsula Drafts*	*TOTAL*		*Hetch Hetchy*	*Calaveras Reservoir Drafts*	*San Antonio Reservoir Drafts*	*Peninsula Drafts*	*TOTAL*
Critical Dry Year						**Average Year**					
Oct-1976	301	0	0	52	257	Oct 1994-1998	276	26	4	51	312
Nov-1976	217	0	0	52	152	Nov 1994-1999	230	30	3	46	261
Dec-1976	199	0	0	54	142	Dec 1994-2000	206	15	3	32	211
Jan-1977	204	0	0	56	132	Jan 1994-1998	188	16	4	40	215
Feb-1977	72	0	22	77	114	Feb 1994-1998	168	20	6	62	227
Mar-1977	77	0	18	60	116	Mar 1994-1998	205	32	6	50	258
Apr-1977	78	0	26	93	124	Apr 1994-1998	236	35	3	54	290
May-1977	83	0	21	84	114	May 1994-1998	271	22	4	42	304
Jun-1977	130	0	8	70	131	Jun 1994-1998	290	40	5	45	355
Jul-1977	126	0	0	103	139	Jul 1994-1998	290	49	5	50	372
Aug-1977	126	1	0	100	137	Aug 1994-1998	290	54	4	52	371
Sep-1977	149	0	14	58	122	Sep 1994-1998	290	40	7	48	346
WY Average	147	0	9	72	140	WY Average	245	32	5	48	294
WY Average (AFY)	164,710	120	10,250	80,190	156,820	WY Average (AFY)	274,450	35,410	5,040	53,410	328,810
Extended Dry Year											
Oct-1986	251	27	7	60	290	Oct-1989	248	4	0	15	257
Nov-1986	155	48	32	67	271	Nov-1989	234	8	0	2	231
Dec-1986	155	40	15	55	278	Dec-1989	160	27	4	17	207
Jan-1987	155	25	15	35	215	Jan-1990	162	14	6	17	189
Feb-1987	155	25	15	35	219	Feb-1990	162	39	0	6	180
Mar-1987	150	20	61	53	237	Mar-1990	171	14	0	13	191
Apr-1987	228	29	32	53	304	Apr-1990	211	9	0	13	225
May-1987	297	0	26	56	341	May-1990	227	15	11	14	232
Jun-1987	300	0	31	51	356	Jun-1990	285	0	0	30	239
Jul-1987	196	60	40	58	358	Jul-1990	282	0	1	38	242
Aug-1987	216	50	30	58	356	Aug-1990	243	25	3	25	241
Sep-1987	236	40	35	50	335	Sep-1990	204	29	0	21	224
Oct-1987	295	22	2	36	288	Oct-1990	200	30	5	16	204
Nov-1987	294	11	0	34	232	Nov-1990	141	22	10	16	173
Dec-1987	298	0	0	34	231	Dec-1990	127	12	15	27	172
Jan-1988	301	0	0	37	190	Jan-1991	140	0	15	32	166
Feb-1988	313	0	1	33	225	Feb-1991	65	0	51	48	160
Mar-1988	300	0	2	34	251	Mar-1991	70	12	34	46	153
Apr-1988	219	0	2	51	249	Apr-1991	156	40	3	23	163
May-1988	198	0	20	45	241	May-1991	127	77	3	19	191
Jun-1988	163	34	26	40	252	Jun-1991	71	71	40	28	204
Jul-1988	176	32	30	31	256	Jul-1991	214	5	22	19	221
Aug-1988	193	18	20	28	250	Aug-1991	221	0	22	12	211
Sep-1988	216	0	2	59	232	Sep-1991	193	0	18	36	204
Oct-1988	147	11	0	32	166	Oct-1991	158	0	10	67	193
Nov-1988	152	12	1	33	172	Nov-1991	157	0	0	72	166
Dec-1988	154	2	5	22	163	Dec-1991	158	0	0	61	158
Jan-1989	154	6	0	18	180	Jan-1992	159	0	0	50	149
Feb-1989	155	5	0	21	179	Feb-1992	166	0	0	0	149
Mar-1989	272	1	0	21	175	Mar-1992	161	0	0	0	155
Apr-1989	305	0	1	17	220	Apr-1992	160	2	42	10	216
May-1989	304	0	1	22	257	May-1992	218	0	0	5	215
Jun-1989	277	10	1	47	300	Jun-1992	228	0	1	6	225
Jul-1989	235	25	2	53	310	Jul-1992	175	0	5	56	228
Aug-1989	233	24	4	50	313	Aug-1992	158	10	0	75	235
Sep-1989	288	3	2	8	279	Sep-1992	157	0	20	58	216
WY Average							201	15	11	34	227
WY Average (AFY)							225,640	16,260	12,500	37,840	254,520



Extended Dry Year Analysis (1987 - 1992)

Figure C-29 shows extended drought year supplies.

- Lake Lloyd and Lake Eleanor supplies during this drought have been removed from this data. In addition, South Bay Aqueduct deliveries were made to San Antonio Reservoir from December 1990 through April 1992. Deliveries averaged 40 MGD during this period, and have been removed from transfers into San Antonio Reservoir.

- There was a Hetch Hetchy Aqueduct outage in January through March 1987. During this period, local usage was 45 MGD from Calaveras, and 65 MGD from San Antonio. As a result of this use, Calaveras Reservoir was only 50 percent full in October 1987. Hetch Hetchy Aqueduct supplies have been increased and San Antonio and Calaveras Reservoir supplies have been decreased to estimate supply conditions without a Hetch Hetchy Aqueduct outage.

- Average supply during the historical drought period was 227 MGD (254,000 AFY), with 201 MGD (226,000 AFY) from the Hetch Hetchy Aqueduct, 15 MGD (16,000 AFY) in San Antonio Reservoir drafts, 11 MGD (13,000 AFY) in Calaveras Reservoir drafts, and 34 MGD (38,000 AFY) in Peninsula reservoir drafts. Of the Hetch Hetchy Aqueduct supply, 34 MGD (17 percent) was served through transfers and local storage, and the remaining 167 MGD (83 percent) was served directly. The San Antonio Reservoir drafts were comprised of 8 MGD (73 percent) local supplies and 3 MGD Hetch Hetchy Aqueduct (27 percent). The 11 MGD of Calaveras drafts were comprised entirely of local supplies, and the Peninsula reservoir supplies were approximately 3 MGD (9 percent) local supplies and 31 MGD (91 percent) transfers.

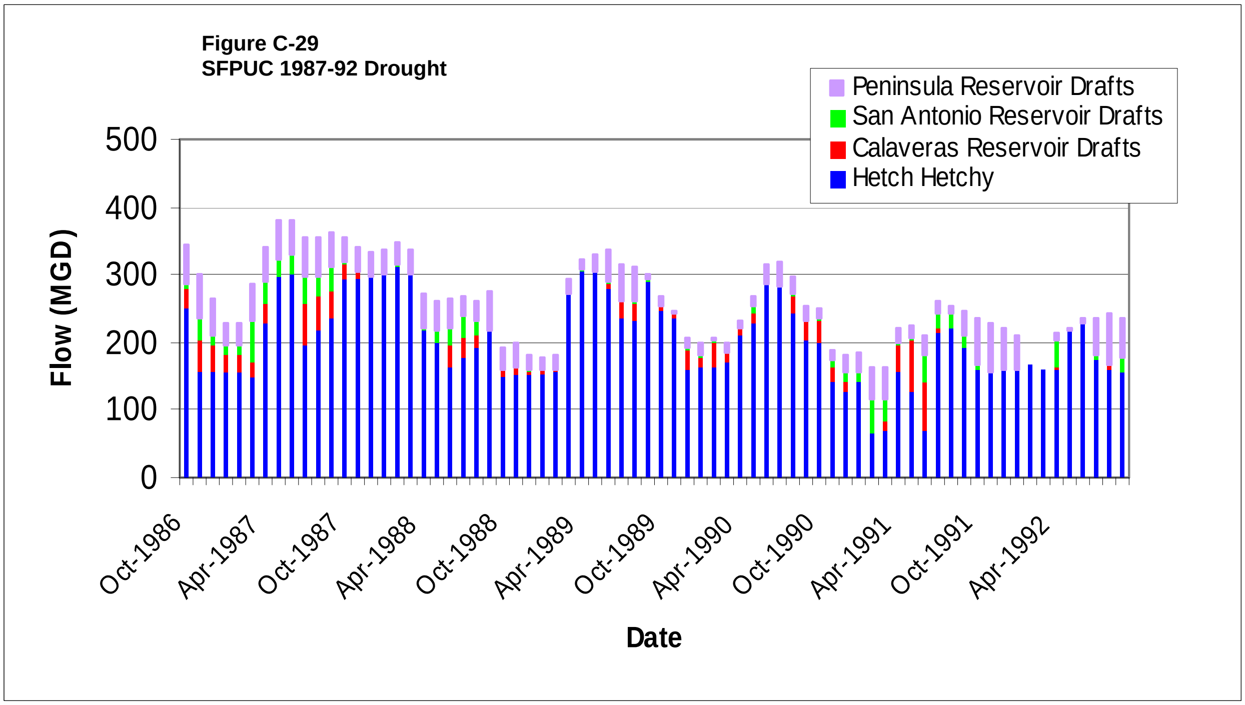


Figure C-29
SFPUC 1987-92 Drought

Average Year Analysis (1994 - 1998)

Figure C-30 shows average year supplies.

- To develop average year baselines for each source, available monthly demand data from 1994-1998 was averaged and used to develop a distribution, which was applied to projected SFPUC year 2020 system demand[20]. Average year Hetch Hetchy Aqueduct supplies were then adjusted to meet projected monthly demand, while maintaining delivery constraints (e.g., 300 MGD). Deliveries to San Antonio Reservoir were reduced, and local reservoir operations were modified such that no net drafts occur from storage over the year. Year 1993 was excluded from calculations because Calaveras Reservoir was re-filling, and SBA transfers to San Antonio continued through February 1993.

- Average system demand is estimated to be 294 MGD (329,000 AFY), with 245 MGD (274,000 AFY) from the Hetch Hetchy Aqueduct, 32 MGD (35,000 AFY) in Calaveras Reservoir drafts, 5 MGD (5,000 AFY) in San Antonio Reservoir drafts, and 48 MGD (53,000 AFY) in Peninsula reservoir drafts. Calaveras and San Antonio Reservoir drafts are comprised entirely of local inflow (32 MGD and 5 MGD, respectively). Peninsula drafts are comprised of 35 MGD (73 percent) Hetch Hetchy transfers, and 13 MGD (27 percent) local inflow.

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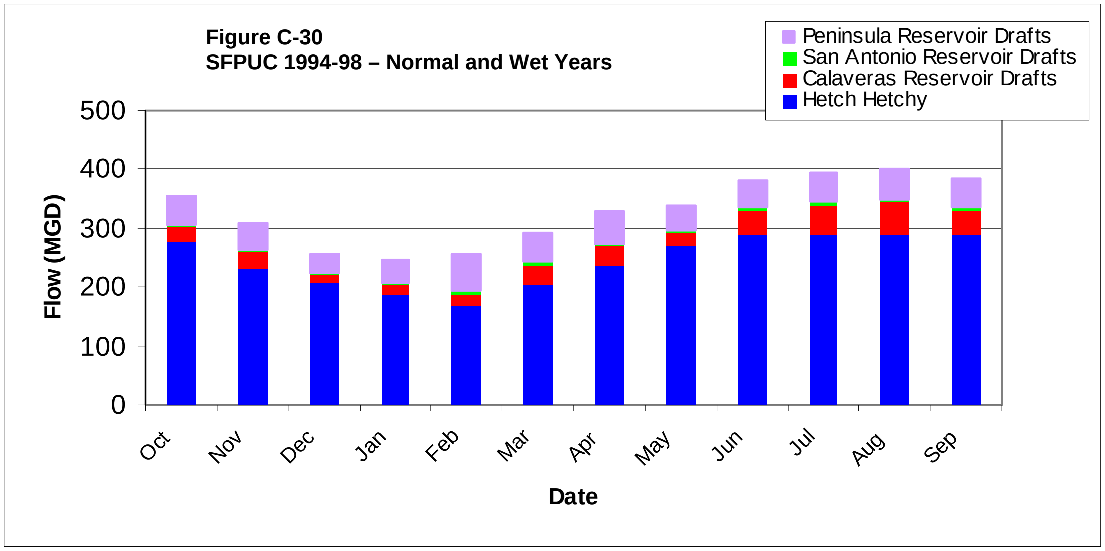
[20] Projected year 2030, average hydrology SFPUC supply purchases by SFPUC wholesale customers (BAWSCA member agencies), were updated in December of 2004. Due to the timeline of this study, as well as the different planning horizon being used in this study (year 2020 rather than year 2030), these projections have not been incorporated into the SFPUC baseline.



3.6.2 Water Quality Data and Baselines

This section provides a brief discussion of the supply data that has been collected, as well as methods implemented to fill in data gaps. In addition, any historical anomalies that could lead to uncharacteristic data being included in the baseline are identified.

Overview

SFPUC water supply sources and facilities are described in Section 3.6.1.

Water Quality Parameters

- **TOC** – monthly point concentrations have been compiled. This data will be used for quantitative water quality and treatment analysis.
- **TDS** – monthly point concentrations have been compiled. This data will be used for quantitative water quality and treatment analysis.
- **Bromide** - monthly point concentrations have been compiled. This data will be used for quantitative water quality and treatment analysis.
- **Temperature, pH** – data has been collected and will be used in a qualitative assessment. No formal baseline will be established for this data.

Historical monthly TOC, TDS and bromide data were collected for the years 1977 and 1987-1999. Limited water quality data is available for these parameters for the late 1970s and 1980s, with the majority of data available dating to the early 1990s and after. Monthly chloride data and annual TDS data were available for all sources during the periods considered. Several relationships have been developed to relate chloride, bromide, and TDS under varying salinity ranges. Because chloride trends are frequently used to estimate TDS and bromide trends, monthly distributions were developed from the historical monthly chloride data. Monthly TDS was estimated by applying these distributions to the annual TDS values reported in historical SFPUC mineral reports. Neither monthly nor annual historical bromide data was available for the periods considered in this study. Studies of Sacramento River bromide and chloride levels indicate that, for chloride levels ranging from approximately 1 to 10 mg/L and bromide levels ranging from approximately 0.002 to 0.1 mg/L, the relationship:

- Bromide = 0.004 * Cl^- where bromide and chloride are in mg/L (22)

can be used to calculate bromide from chloride. This relationship was used to estimate monthly bromide values from historical monthly chloride. Table C-9 describes the sources and methods used to estimate data for the three hydrologic periods being considered.

Table C-9
SFPUC Water Quality Data Sources

	Critical (1977)			***Extended Dry (1987-1992)***			***Average Year***		
	Alameda East Portal	***San Antonio Reservoir***	***Calaveras Reservoir***	***Alameda East Portal***	***San Antonio Reservoir***	***Calaveras Reservoir***	***Alameda East Portal***	***San Antonio Reservoir***	***Calaveras Reservoir***
TOC	Estimated as max monthly values from 1990-2000	Estimated as max monthly values from 1990-2000	Estimated as max monthly values from 1990-2000	Estimated as max monthly values from 1990-2000	Estimated as max monthly values from 1990-2000	Estimated as max monthly values from 1990-2000	Average of 1990-2000 data	Average of 1990-2000 data	Average of 1990-2000 data
TDS	Estimated from monthly chloride distribution and annual TDS from mineral report	Estimated from monthly chloride distribution and annual TDS from mineral report	Estimated from monthly chloride distribution and annual TDS from mineral report	Estimated from monthly chloride distribution and annual TDS from mineral report	Estimated from monthly chloride distribution and annual TDS from mineral report	Estimated from monthly chloride distribution and annual TDS from mineral report	Average of 1990-2000 data	Average of 1990-2000 data	Average of 1990-2000 data
Bromide	Converted from historical chloride: Br=0.004*Cl	Converted from historical chloride: Br=0.004*Cl	Converted from historical chloride: Br=0.004*Cl	Converted from historical chloride: Br=0.004* Cl	Converted from historical chloride: Br=0.004*Cl	Converted from historical chloride: Br=0.004*Cl	Average of 1990-2000 data	Average of 1990-2000 data	Average of 1990-2000 data

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[22] Bromide relationship developed by EBMUD based on Sacramento River data collected from 1985 through1991.

Critical Dry Year Analysis (1977)

Figures C-31a, C-31b and C-31c show the critical year baseline values for TOC, TDS and bromide by source.

- To estimate Hetch Hetchy Aqueduct critical year TOC, we used the maximum historical data values for each month over the months and years for which there is Alameda East Portal TOC data (1992 through 2000). Hetch Hetchy Aqueduct TOC for June, 1977, was estimated to be 5.4 mg/L, more than twice the value of the May and July estimates. As such, this value was determined to be an outlier and was replaced with the May-July interpolated value of 2.2 mg/L. To estimate Hetch Hetchy Aqueduct TDS, we used historical monthly Alameda East Portal chloride data to develop a distribution. This distribution was then applied to historical annual Alameda East Portal TDS values. Monthly bromide concentrations were estimated using the chloride correlation described above.

- To estimate San Antonio Reservoir critical year TOC, we used the maximum historical data values for each month over the months and years for which there is San Antonio Reservoir data (1990 through 2000). To estimate San Antonio Reservoir TDS, we used historical monthly San Antonio Reservoir chloride data to develop a distribution. This distribution was then applied to historical annual San Antonio Reservoir TDS values. Monthly bromide concentrations were estimated using the chloride correlation described above.

- No Calaveras Reservoir deliveries were made during the critical year, however a critical year water quality baseline was developed for Calaveras Reservoir, and may be used in estimation of Calaveras Reservoir Expansion concept water quality. To estimate Calaveras Reservoir critical year TOC, we used the maximum historical data values for each month over the months and years for which there is Calaveras Reservoir data (1990 through 2000). To estimate Calaveras Reservoir TDS, we used historical monthly Calaveras Reservoir chloride data to develop a distribution. This distribution was then applied to historical annual Calaveras Reservoir TDS values. Monthly bromide concentrations were estimated using the chloride correlation described above.

- In the blended water quality dataset, Calaveras Reservoir and San Antonio Reservoir TOC estimates were reduced by 30 percent, as expected through treatment at the Sunol Valley Water Treatment Plant.

Figure C-31a
SFPUC Critical Year Historical and Baseline TDS

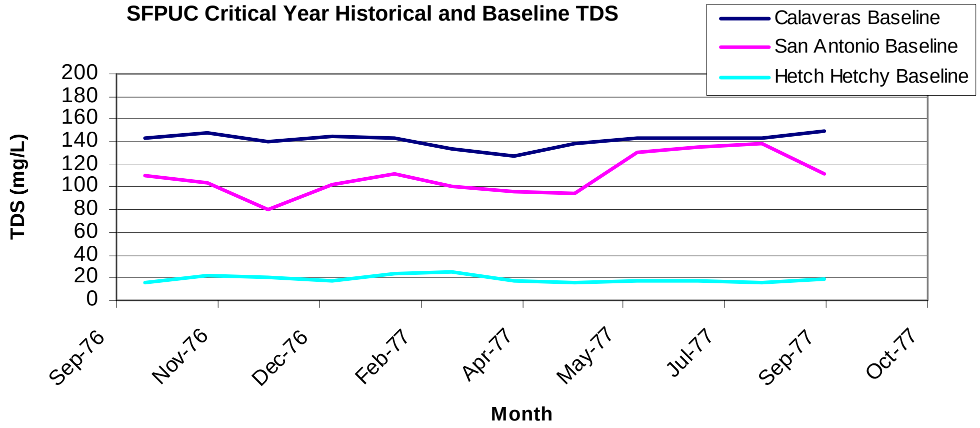


Figure C-31b
SFPUC Critical Year Historical and Baseline TOC

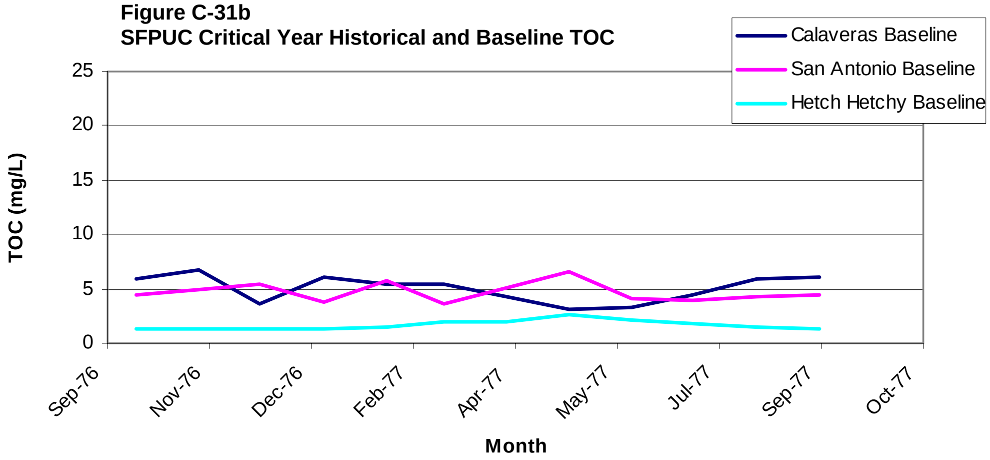
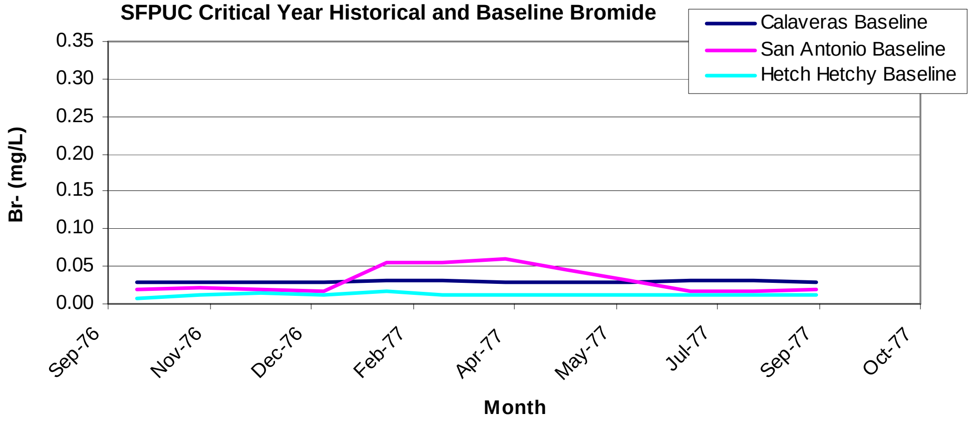


Figure C-31c
SFPUC Critical Year Historical and Baseline Bromide



Extended Dry Year Analysis (1987-1992)

Figures C-32a, C-32b and C-32c show the extended dry year baseline values for TOC, TDS and bromide by source.

- No Alameda East Portal TOC data was available for 1987-1992. To estimate Hetch Hetchy Aqueduct critical year TOC, we used the maximum historical data values for each month over the months and years for which there is Alameda East Portal TOC data (1992 through 2000). To estimate Hetch Hetchy Aqueduct TDS, we used historical monthly Alameda East Portal chloride data to develop a distribution. This distribution was then applied to historical annual Alameda East Portal TDS values. Monthly bromide concentrations were estimated using the chloride correlation described above.

- San Antonio Reservoir historical TOC data was available for most months from 1990 to 1992. Gaps were filled in using interpolation. To estimate San Antonio Reservoir TDS, we used historical monthly San Antonio Reservoir chloride data to develop a distribution. This distribution was then applied to historical annual San Antonio Reservoir TDS values. Monthly bromide concentrations were estimated using the chloride correlation described above.

- Monthly Calaveras TOC data was available for the greater part of 1990. Maximum monthly values for available TOC data to fill in data gaps in 1990 TOC data.[23] The 1990 values were used to approximate 1987-1992 conditions To estimate Calaveras Reservoir TDS, we used historical monthly Calaveras Reservoir chloride data to develop a distribution. This distribution was then applied to historical annual Calaveras Reservoir TDS values. Monthly bromide concentrations were estimated using the chloride correlation described above.

- In the blended water quality dataset, Calaveras Reservoir and San Antonio Reservoir TOC estimates were reduced by 30 percent, as expected through treatment at the Sunol Valley Water Treatment Plant.

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[23] Anomalous high TOC values were observed for Calaveras reservoir in April and August of 1990 [21 and 13 mg/L, respectively]. It is assumed that these high estimates were the result of surface samples and do not accurately reflect reservoir water quality. As a result, these values were omitted from the baseline calculations.

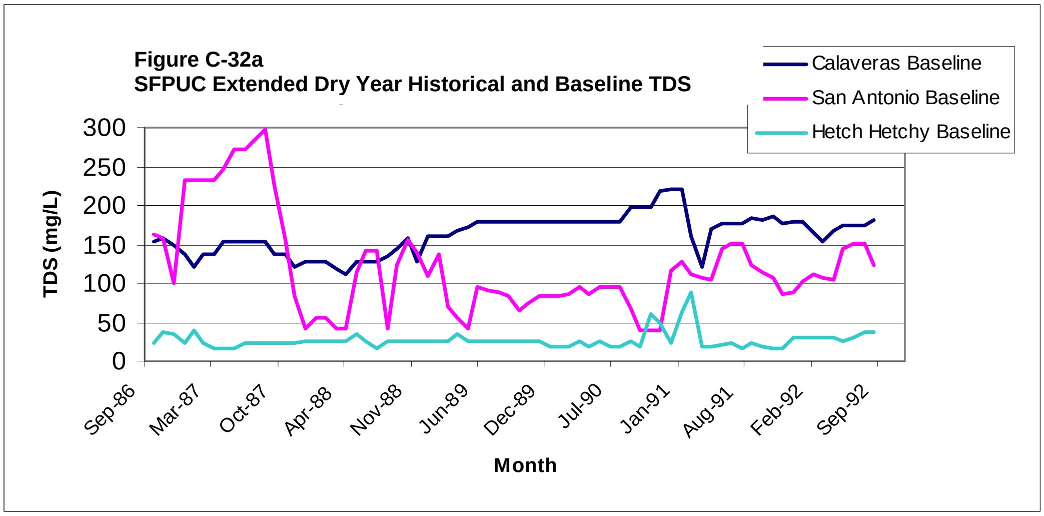


Figure C-32a
SFPUC Extended Dry Year Historical and Baseline TDS

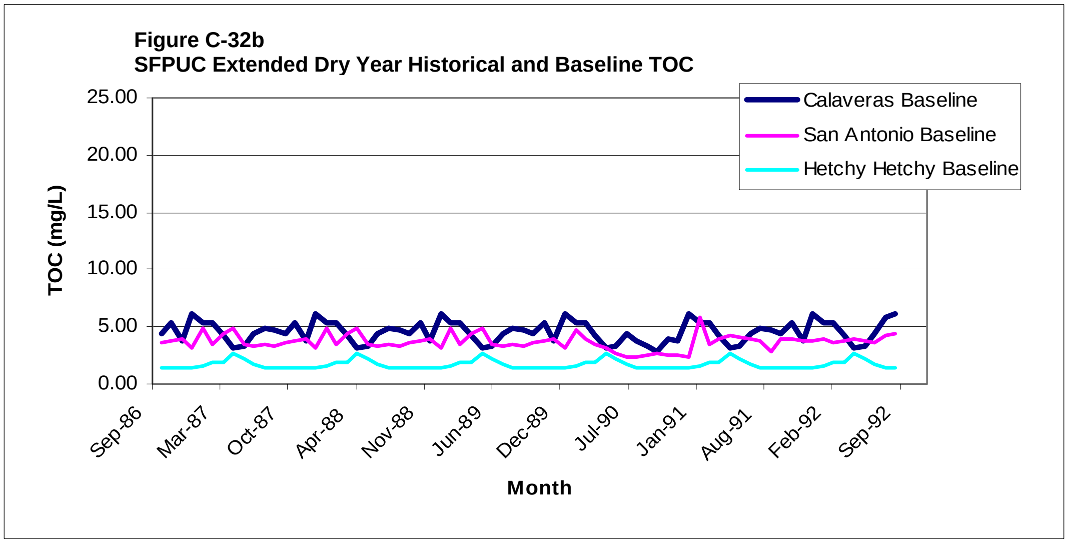


Figure C-32b
SFPUC Extended Dry Year Historical and Baseline TOC

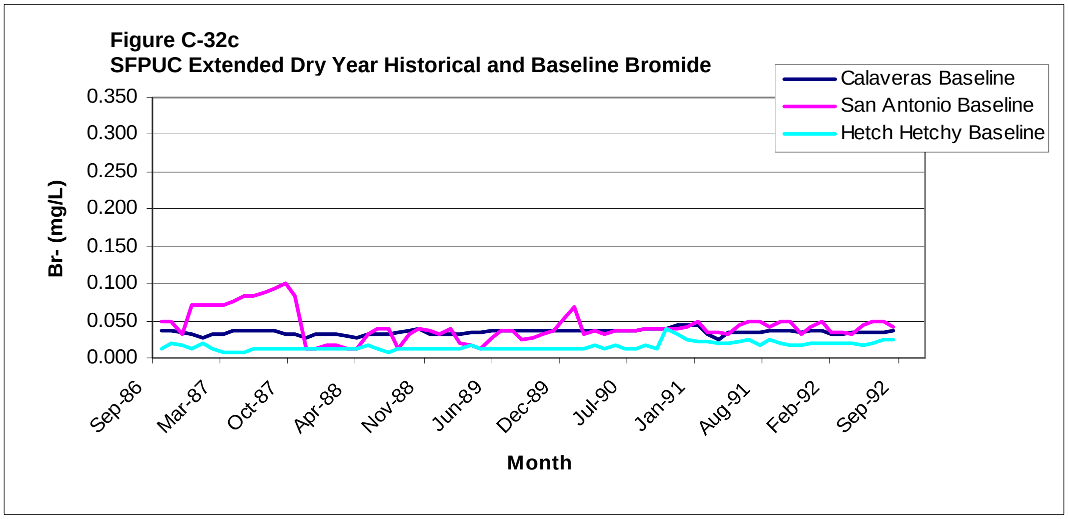


Figure C-32c
SFPUC Extended Dry Year Historical and Baseline Bromide

Average Hydrologic Year Analysis (1994-1998)

Figure C-33a, C-33b and C-33c show the average year baseline values for each constituent and source.

- To develop average year baselines for each source, available monthly data for Calaveras Reservoir, San Antonio Reservoir, and Alameda East Portal from 1994-1998 were averaged, respectively.
- In the blended water quality dataset, Calaveras Reservoir and San Antonio Reservoir TOC estimates were reduced by 30 percent, based on anticipated removal through treatment at the Sunol Valley Water Treatment Plant.

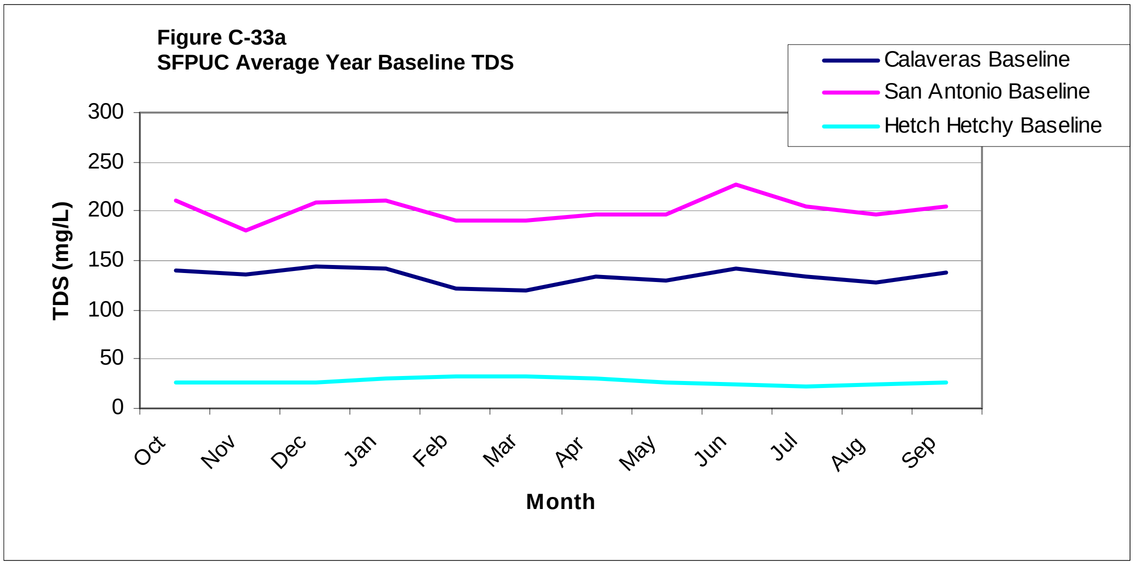


Figure C-33a
SFPUC Average Year Baseline TDS

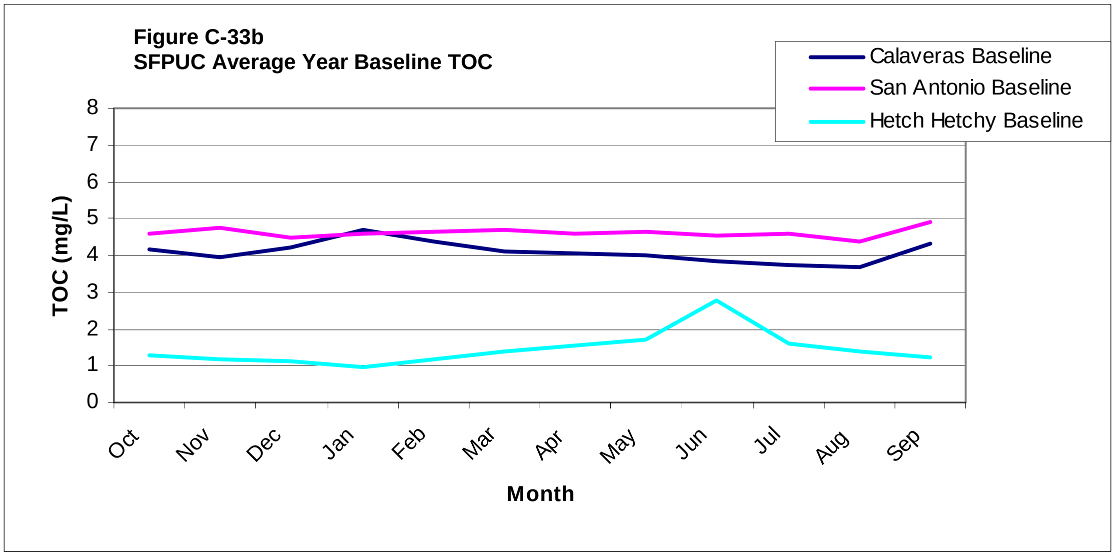
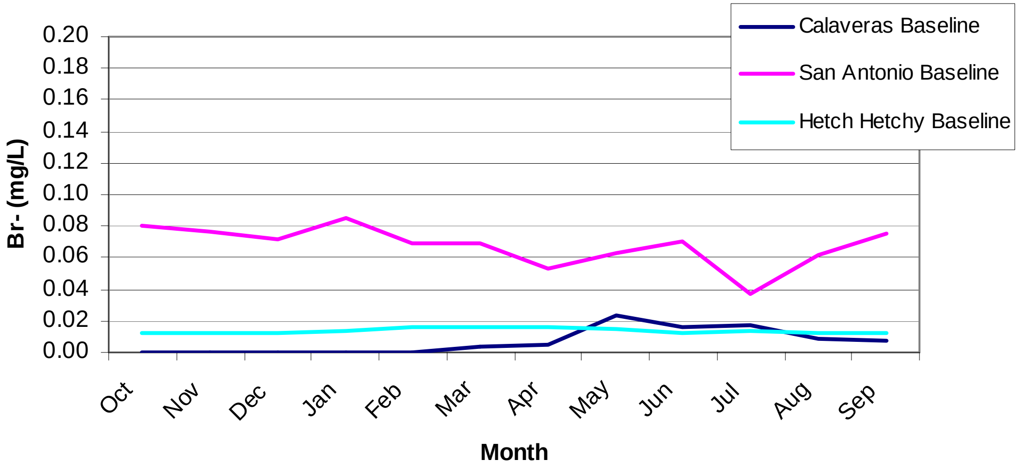


Figure C-33b
SFPUC Average Year Baseline TOC

Figure C-33c
SFPUC Average Year Baseline Bromide



Blended Water Quality

Figures C-34a, C-34b and C-34c summarize the proposed blended water quality baselines for the SFPUC. The baselines presented in these graphs represent the historical mixture of Hetch Hetchy Aqueduct, San Antonio Reservoir, Calaveras Reservoir supplies entering the Bay Division Pipelines (TOC contributions from the Sunol sources have been reduced by 30% to simulate reductions achieved at Sunol Valley Water Treatment Plant) under the three different hydrologic conditions.

Figure C-34a
Blended Sources Delivered to Bay Division Pipelines – Baseline TOC Concentrations

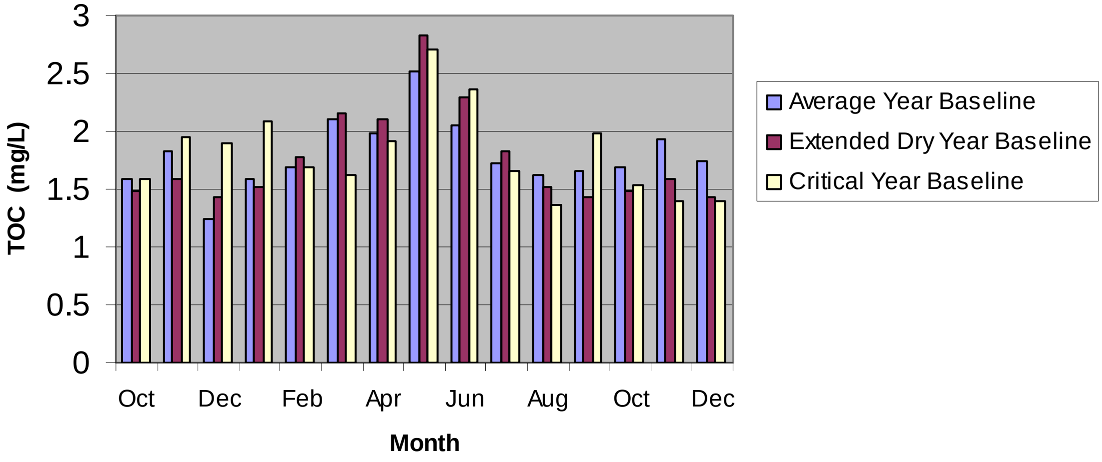


Figure C-34b
Blended Sources Delivered to Bay Division Pipelines – Baseline TDS Concentrations

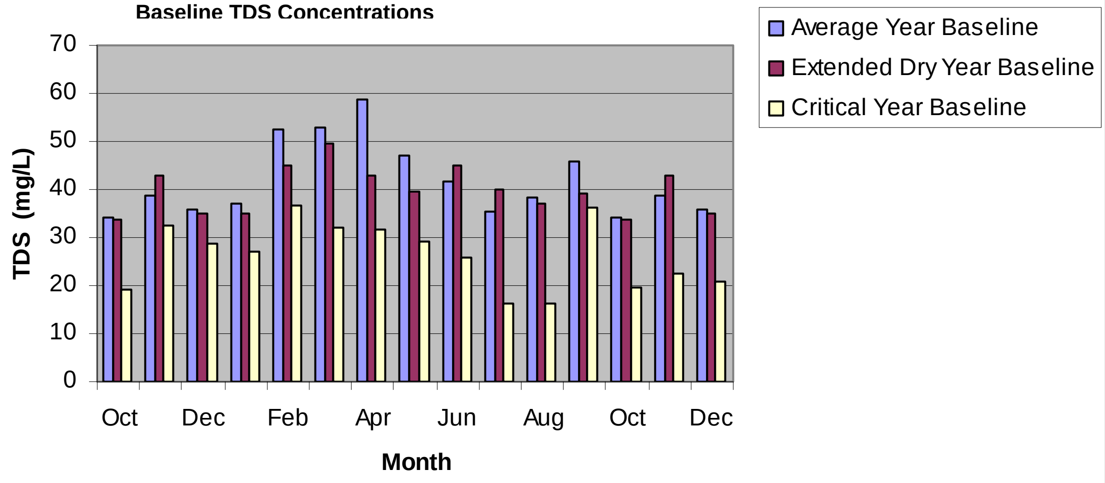
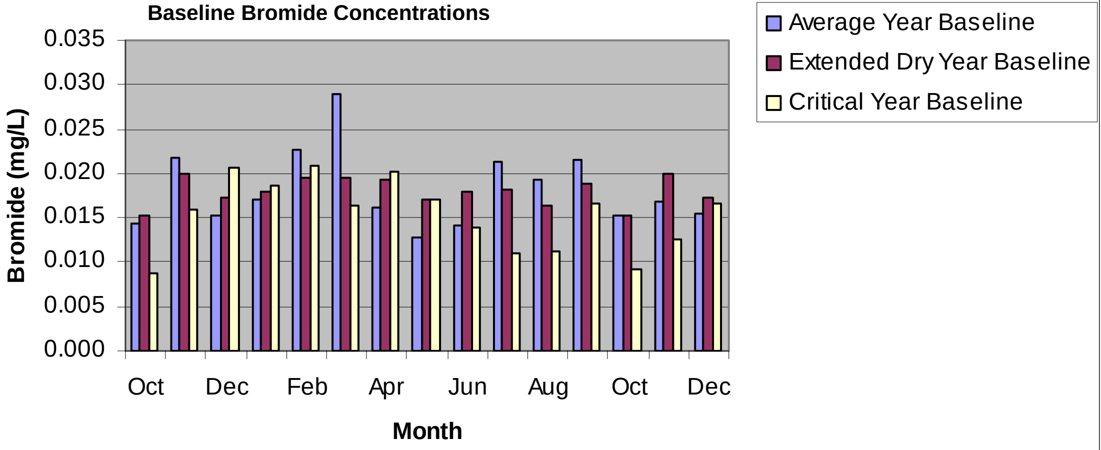


Figure C-34c
Blended Sources Delivered to Bay Division Pipelines – Baseline Bromide Concentrations



3.7 Zone 7 Water Agency (Zone 7)

3.7.1 Water Supply Data and Baselines

This section provides a brief discussion of the water supply data that has been collected, as well as any historical anomalies that could lead to uncharacteristic data being included in the baseline.

Overview

Supplies

- State Water Project (SWP) Supplies
- Local groundwater supplies - not included in this study

Zone 7 receives supplies from the State Water Project (SWP) via the South Bay Aqueduct (SBA). Zone 7's supply baseline for SWP deliveries was developed using simulated data developed by Zone 7 for use by the Expanded Los Vaqueros Studies Team. These deliveries use the CALFED common assumptions working group OCAP Study 4.[24]

This flow data is reviewed below for the three hydrologic periods to be used, and is summarized in Table C-10.

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[24] This simulation includes 2020 level of development and hydrology, Central Valley Improvement Act 3406(b)2 provisions, South Delta Improvements, Freeport Regional Water Project, and H.O. Banks Pumping Plant at 8,500 cfs capacity. The Expanded Los Vaqueros study team used this run as a basis for Expanded Los Vaqueros operations, and included operations for the Environmental Water Account.

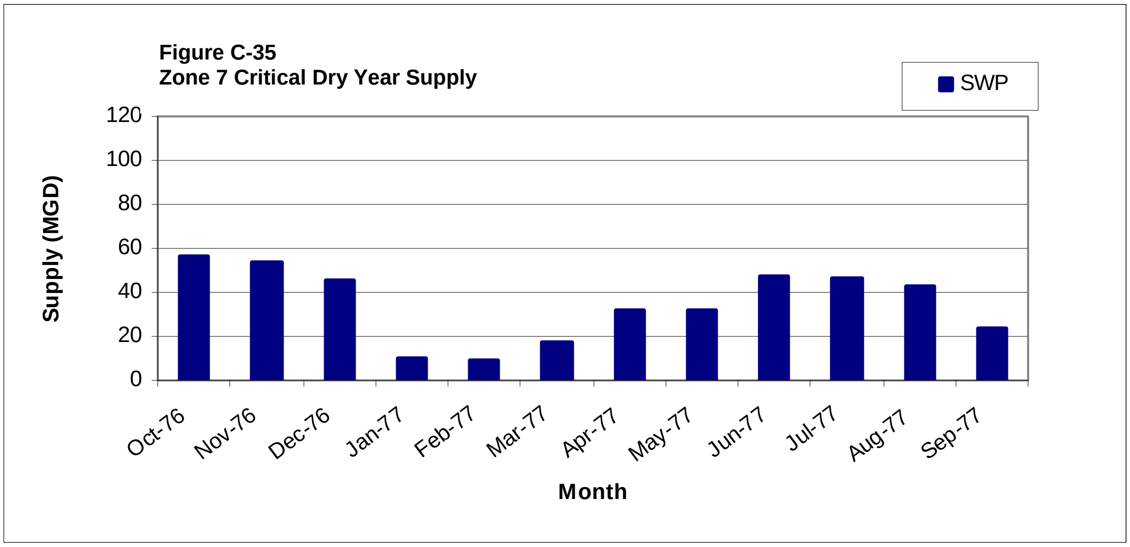
Table C-10
Zone 7 Water Supply Baseline (MGD)

Month	SWP Supply	Month	SWP Supply
Critical Dry Year		**Average Year**	
Oct-76	56.4	Oct (Average Year)	59.7
Nov-76	54.0	Nov (Average Year)	60.6
Dec-76	45.3	Dec (Average Year)	51.9
Jan-77	10.0	Jan (Average Year)	68.2
Feb-77	9.5	Feb (Average Year)	67.7
Mar-77	17.6	Mar (Average Year)	48.4
Apr-77	32.2	Apr (Average Year)	63.0
May-77	31.7	May (Average Year)	66.3
Jun-77	47.1	Jun (Average Year)	72.4
Jul-77	46.5	Jul (Average Year)	71.8
Aug-77	42.4	Aug (Average Year)	67.7
Sep-77	24.1	Sep (Average Year)	67.5
WY Average	34.7	WY Average	63.8
WY Average (AFY)	38,900	WY Average (AFY)	71,430
Extended Dry Year			
Oct-1986	61.1	Oct-1989	64.2
Nov-1986	63.4	Nov-1989	69.5
Dec-1986	54.7	Dec-1989	60.8
Jan-1987	53.4	Jan-1990	31.9
Feb-1987	52.9	Feb-1990	31.4
Mar-1987	41.0	Mar-1990	24.5
Apr-1987	55.6	Apr-1990	39.1
May-1987	66.3	May-1990	60.5
Jun-1987	72.4	Jun-1990	60.8
Jul-1987	71.8	Jul-1990	60.2
Aug-1987	67.7	Aug-1990	56.1
Sep-1987	60.1	Sep-1990	37.8
Oct-1987	55.8	Oct-1990	33.5
Nov-1987	52.7	Nov-1990	25.5
Dec-1987	44.0	Dec-1990	16.8
Jan-1988	31.9	Jan-1991	31.9
Feb-1988	31.4	Feb-1991	31.4
Mar-1988	24.4	Mar-1991	24.8
Apr-1988	39.0	Apr-1991	39.4
May-1988	60.4	May-1991	60.8
Jun-1988	60.7	Jun-1991	61.5
Jul-1988	60.1	Jul-1991	60.8
Aug-1988	56.0	Aug-1991	56.8
Sep-1988	37.7	Sep-1991	38.4
Oct-1988	33.4	Oct-1991	34.1
Nov-1988	25.4	Nov-1991	25.8
Dec-1988	16.7	Dec-1991	17.1
Jan-1989	70.1	Jan-1992	31.9
Feb-1989	69.6	Feb-1992	31.4
Mar-1989	49.4	Mar-1992	35.4
Apr-1989	64.0	Apr-1992	50.0
May-1989	66.3	May-1992	71.4
Jun-1989	72.4	Jun-1992	82.7
Jul-1989	71.8	Jul-1992	82.0
Aug-1989	67.7	Aug-1992	78.0
Sep-1989	68.5	Sep-1992	59.6
Average			50.4
Average (AFY)			56,440

Critical Dry Year Analysis (WY 1977)

Figure C-35 shows critical year imported supplies for Zone 7.

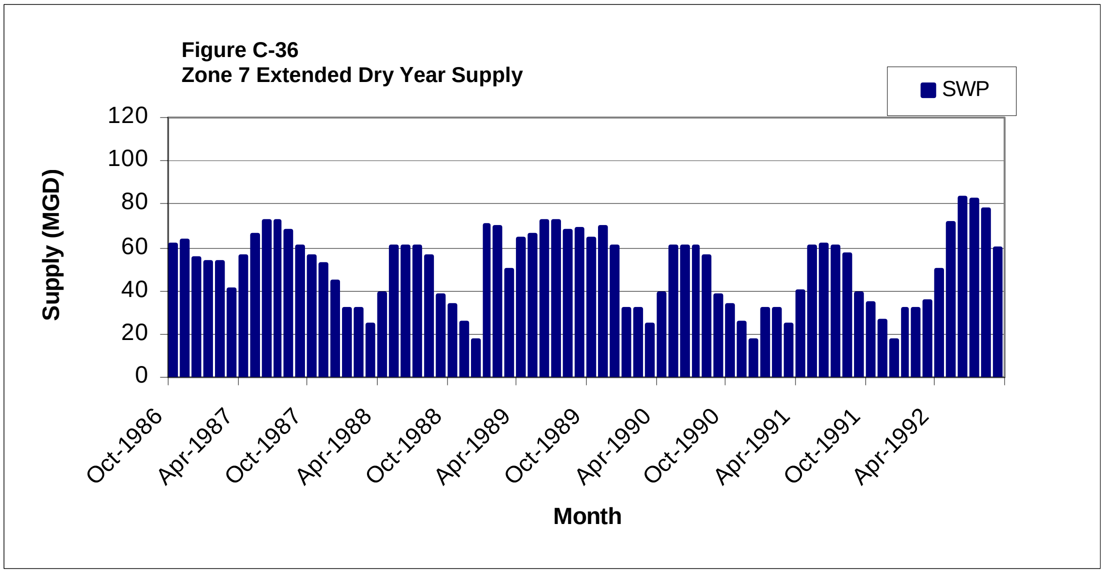
- Total critical year Zone 7 SWP supply is projected to be 35 MGD (39,000 AFY).



Extended Dry Year Analysis (WY 1987 - 1992)

Figure C-36 shows drought year supplies.

- Average extended dry year Zone 7 SWP supply is projected to be 50 MGD (56,000 AFY).

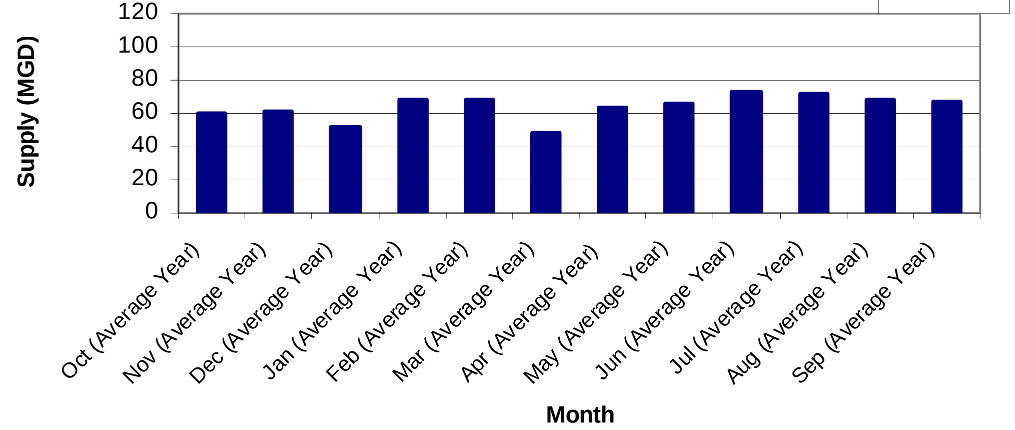


Average Year Analysis (WY 1994-1998, 1984)

Figure C-37 shows average year supplies.

- Average year Zone 7 SWP supply is projected to be 64 MGD (71,000 AFY).

Figure C-37
Zone 7 Average Year Supply



3.7.2 Water Quality Data and Baselines

This section provides a brief discussion of the water quality data that has been collected, as well as methods implemented to fill in data gaps. In addition, any historical anomalies that could lead to uncharacteristic data being included in the baseline are identified.

Overview

Supplies

Zone 7 water supply sources and facilities are described in Section 3.7.1.

Water Quality Parameters

- **TOC** – monthly blended point concentrations have been compiled. This data will be used for quantitative water quality and treatment analysis.
- **TDS** – monthly simulated SWP chloride data was converted to TDS. This data will be used for quantitative water quality and treatment analysis.
- **Bromide** - monthly simulated SWP chloride data was converted to bromide. This data will be used for quantitative water quality and treatment analysis.

- **Temperature, pH** – data has been collected for the SWP supply and will be used in a qualitative assessment. No formal baseline will be established for this data.

Simulated bromide and TDS were calculated from simulated chloride data for the Clifton Court Forebay.

Harvey O. Banks Pumping Plant dissolved oxygen carbon (DOC) data was collected from 1986 through 1997. This data was used as a surrogate for 1987 through 1992 extended dry year TOC data. In addition, Banks 1990 through 1997 DOC data was averaged by month to obtain monthly TOC concentrations for the average hydrology baseline. Maximum monthly values taken over the extended dry period (1987 through 1992) were used to estimate critical dry year (1977) TOC concentrations.

A SWP water quality baseline was developed from the water quality estimates for SWP deliveries developed by the CALFED Los Vaqueros Studies (using DSM II) in conjunction with historical DOC data, as described above.

Critical Dry Year Analysis

Figures C-38a through C-38c show the critical year baseline values for TOC, TDS and bromide by source, on a calendar year and water year basis, with 1977 being taken as critical year hydrology.

Figure C-38a
SWP Critical Year TOC Baseline

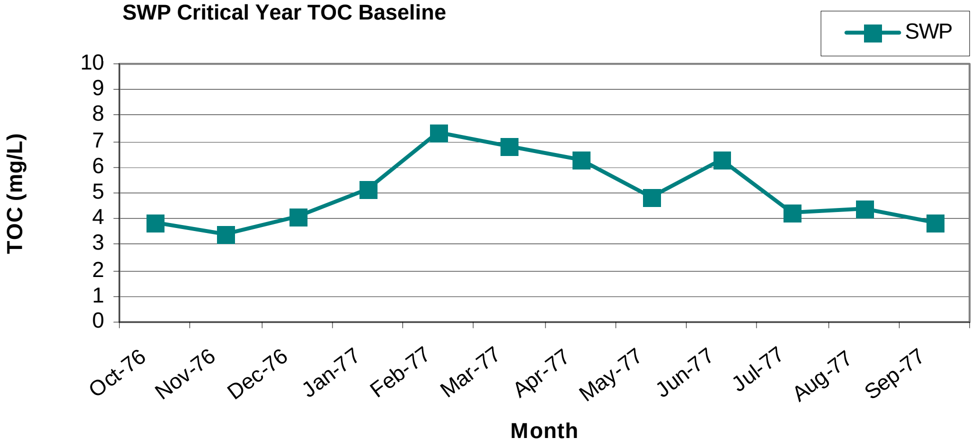


Figure C-38b
SWP Critical Dry Year TDS Baseline

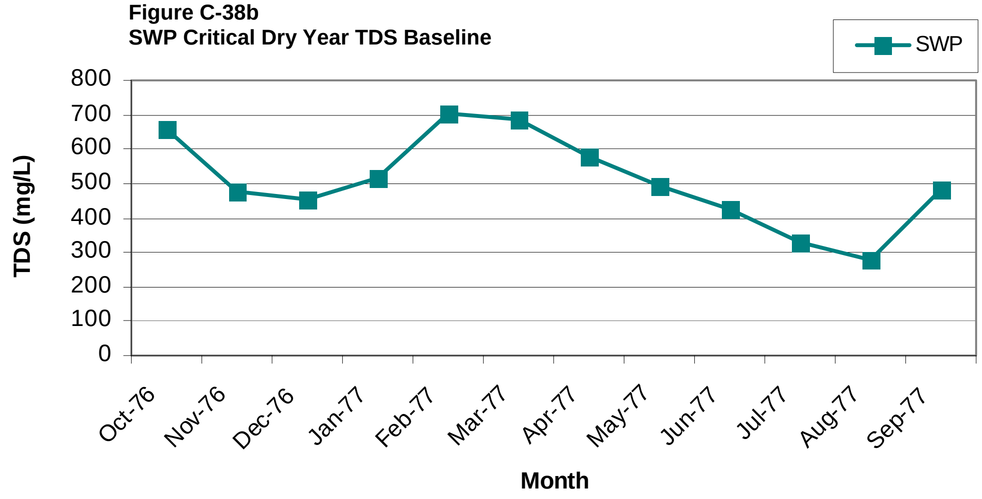
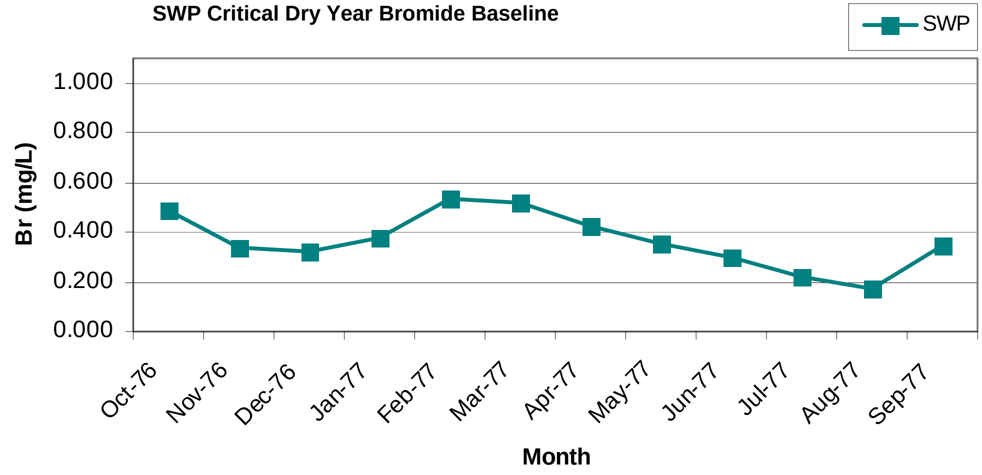


Figure C-38c
SWP Critical Dry Year Bromide Baseline



Extended Dry Year Analysis

Figures C-39a, C-39b, and C-39c show the extended dry year baseline values for TOC, TDS and bromide by source, with water years 1987 through 1992 being taken as critical year hydrology.

Figure C-39a
SWP Extended Dry Year TOC Baseline

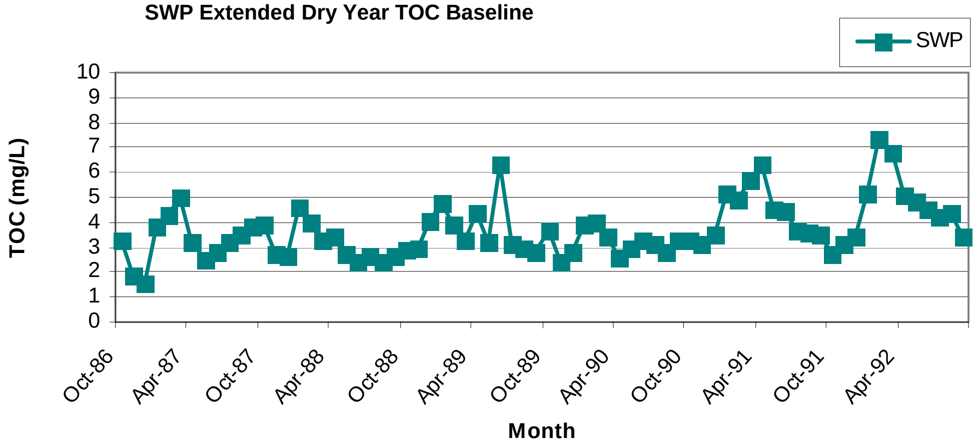


Figure C-39b
SWP Extended Dry Year TDS Baseline

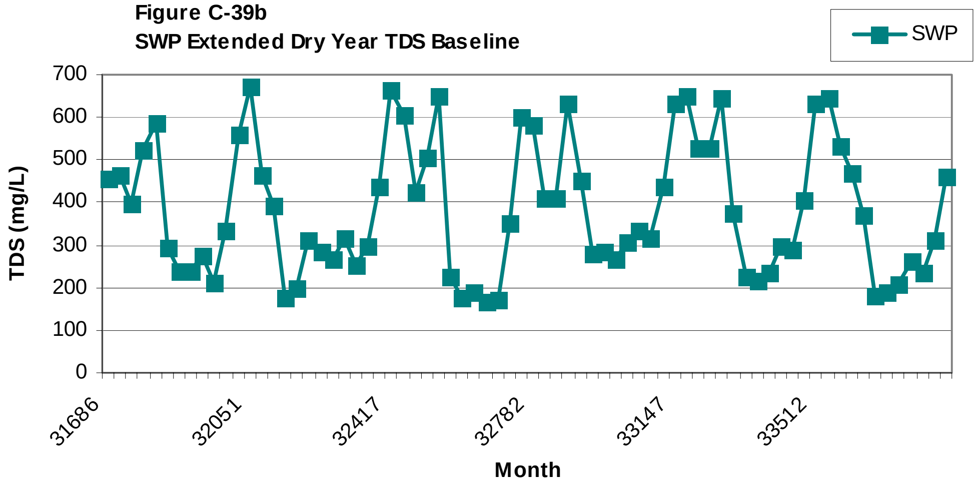
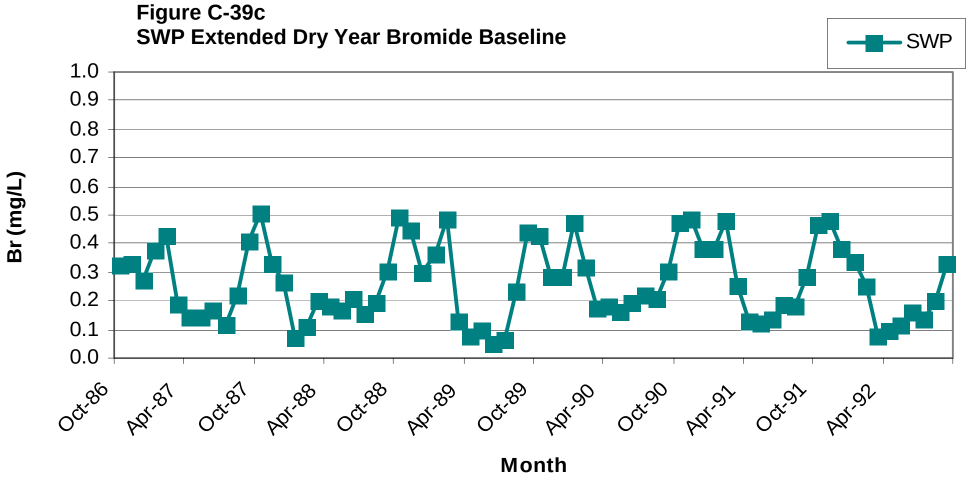


Figure C-39c
SWP Extended Dry Year Bromide Baseline



Average Hydrologic Year Analysis

Figure C-40a, C-40b and C-40c show the average year baseline values for each constituent and source. Long term averages were used for SWP average year hydrology.

Figure C-40a
SWP Average Year TOC Baseline

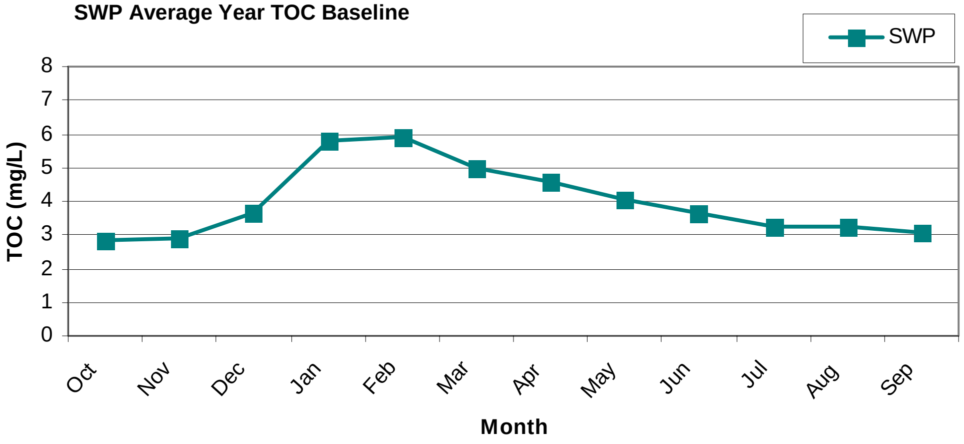


Figure C-40b
SWP Average Year TDS Baseline

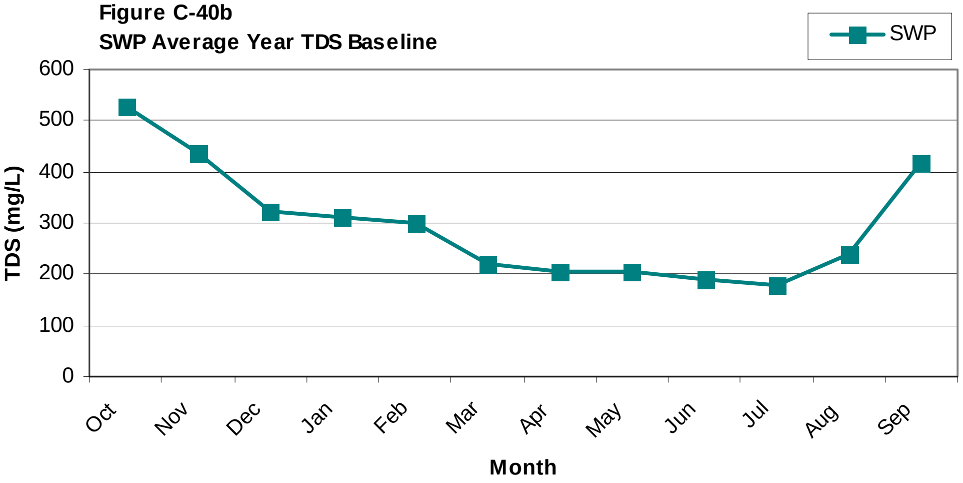
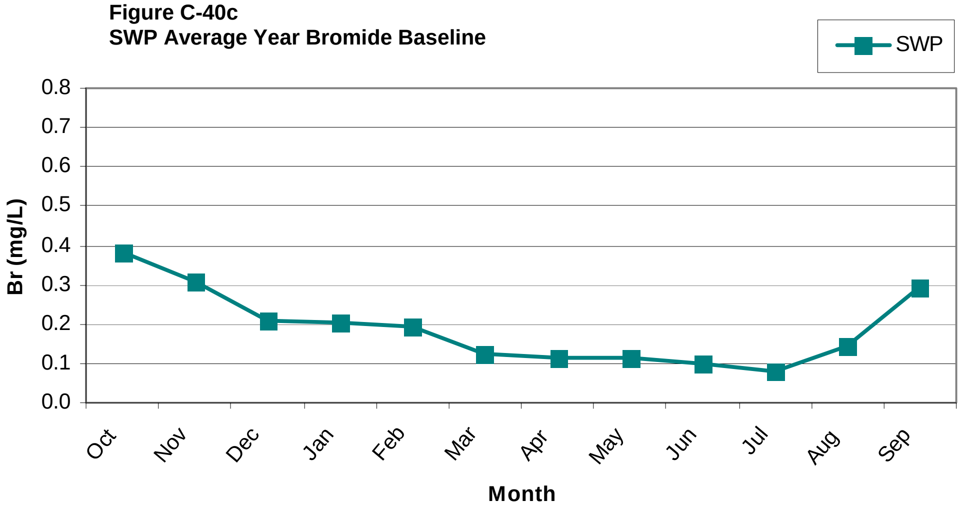


Figure C-40c
SWP Average Year Bromide Baseline



Appendix D

Water Treatment

Appendix D
Water Treatment

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Appendix D
Water Treatment

This technical memorandum presents the current and planned water treatment processes for the agencies participating in the Bay Area Water Quality and Water Supply Reliability Program (BAWQ&WSRP). In addition, it describes the methodology that will be used for projecting and presenting treated water quality results for agencies with potential concept implementation. The study includes the following participating agencies: Alameda County Water District (ACWD),Bay Area Water Supply and Conservation Authority (BAWSCA); Contra Costa Water District (CCWD); East Bay Municipal Utility District (EBMUD); San Francisco Public Utilities Commission (SFPUC); Santa Clara Valley Water District (SCVWD); and Zone 7 Water Agency (Zone 7).

Table D-1 describes the treatment processes currently in place and planned modifications for the participating water agencies.

Table D-1
Treatment Processes Used by Participating Utilities

Agency	*Sources Treated by Agency*	*Plant*	*Current Treatment Processes(1)*	*Planned Modifications*
Alameda County Water District	South Bay Aqueduct	Mission San Jose[1]	Coagulation, flocculation, upflow clarification, Powdered Activated Carbon (PAC), ultrafiltration, chlorine	Disinfection Optimization
		WTP 2	pH adjustment, preozonation, coagulation, flocculation, sedimentation, dual media filtration, chlorine	
Contra Costa Water District	Delta	Randall-Bold	Pre-ozonation, coagulation, flocculation, Granular Activated Carbon (GAC) dual media filtration, post-ozonation	Modifications to increase capacity to 80 MGD (ultimate), addition of sedimentation basins and filter modifications, settled water ozone, pH adjustment, ozone quenching
		Bollman	Coagulation, flocculation, sedimentation, settled water ozonation, GAC dual-media filtration, Sulfuric Acid (H_2SO_4)	Possible upgrades to solids handling system, Hydrogen Peroxide (H_2O_2), ozone quenching

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[1] ACWD is currently completing a major upgrade of its Mission San Jose Water Treatment Plant (MSJWTP), converting from conventional treatment to an ultrafiltration facility. It is designed to meet and/or exceed all future drinking water standards considered under the D/DBP2 rule. Since there is no operating data based on planned future operations of MSJWTP, a basic process train has been modeled for this study to provide water quality comparisons of the alternatives, yielding results which do not reflect planned future operations.

Table D-1
Treatment Processes Used by Participating Utilities

Agency	***Sources Treated by Agency***	***Plant***	***Current Treatment Processes[1]***	***Planned Modifications***
East Bay Municipal Utility District	Sierra	Sobrante	Coagulation, sedimentation, ozonation, GAC filtration	
		Upper San Leandro	Coagulation, sedimentation, ozonation, GAC filtration	
		Orinda	Coagulation, chlorine, filtration	
		Lafayette	Coagulation, chlorine, filtration	
		Walnut Creek	Coagulation, chlorine, filtration	
San Francisco Public Utilities Commission[2]	Sierra	Harry Tracy WTP	Ozone, coagulation, filtration, chlorine	
		Sunol Valley WTP	Chlorine, coagulation, sedimentation, filtration	
		Tesla Portal Hypochlorite Station	Chlorine	UV? Ozone?
Santa Clara Valley Water District[3]	South Bay Aqueduct San Luis Reservoir	Penitencia	Horizontal flow-through flocculation-sedimentation basins and dual media filters	Ozone disinfection, washwater clarification,
				hydrogen peroxide, sulfuric acid
		Santa Teresa	Horizontal flow-through flocculation-sedimentation basins and dual media filters	Ozone disinfection, washwater clarification,
				hydrogen peroxide, sulfuric acid, filter-to-waste
		Rinconada	Conventional treatment, with upflow clarifiers and dual-media filters	Ozone disinfection, washwater clarification,
				hydrogen peroxide, sulfuric acid, filter-to-waste, increase plant production capacity to 100 mgd
Zone 7	South Bay Aqueduct	Del Valle	Coagulation, clarification with superpulsators, dual media filtration	
		Patterson Pass I	Coagulation, clarification with upflow clarifier and dual-media filters	
		Patterson Pass II	Coagulation, clarification with upflow clarifier, ultrafiltration	
		Altamont		To be determined

(1) All Systems are chloraminated.

(2) SFPUC treats all supply delivered to BAWSCA agencies.

(3) SCVWD treats all supply delivered to BAWSCA agencies in Santa Clara County.

Projecting Future Performance

Water quality impacts and/or benefits associated with concepts and example portfolios being analyzed in this study will be evaluated both before and after treatment. To determine the effect of treatment on water quality, total dissolved solids (TDS) and trihalomethane (THM), haloacetic acid (HAA), and bromate production will be modeled, as described below. These parameters will be compared with baseline values, calculated based on existing and planned treatment.

TDS Modeling

Effluent TDS will be calculated by mass balance, assuming influent TDS is conservative. Additional TDS contribution by the treatment process will also be considered.

Disinfection By-Product (DBP) Modeling

Based on influent water quality parameters including bromide and TOC, effluent THM, HAA and bromate concentrations will be projected using the U.S. Environmental Protection Agency (USEPA) Water Treatment Plant (WTP) model.

The USEPA WTP model will be used to model distribution system DBP concentrations. This model predicts: (1) the behavior of water quality parameters that impact the formation of disinfection by-products (DBPs); and (2) the formation of DBPs. It was developed in 1992 (version 1.5) and used to support the Disinfectant/Disinfection By-product (D/DBP) regulation negotiations (Reg/Neg) process in 1993-94. It was modified (version 2.0) to support the Federal Advisory Committee Act (FACA) process for USEPA's Microbial/Disinfection Byproduct Rule cluster in 1999-2000. The WTP model uses empirical correlations to predict central tendencies for natural organic matter (NOM) removal, disinfection, and DBP formation for specified treatment processes. NOM characteristics, total organic carbon (TOC) and ultraviolet absorbance at 254 nm (UVA), bromide concentration, temperature, pH, disinfectant dose and reaction times are used to predict trihalomethane (THM) and haloacetic acid (HAA) formation. The bromate model of Ozekin and Amy[2] is used within the model to determine bromate formation based on ozone dose, bromide, DOC (not defined), and pH. The equation used:

$$BrO_3 = 1.63x10^{-6}\ DOC^{-1.26}\ pH^{5.82}\ (O_3\ dose)^{1.57}\ Br^{0.73}\ time^{0.28}$$

was developed based on Delta source water diversions, and generally had source bromide and bromate levels ranging from 70 to 440 µg/L, and 2 to 314 µg/L, respectively.

Parameters used to model agency water treatment plants are included in Appendix A. This information was developed based on the treatment processes described above.

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[2] Amy, G.L., M. Siddiqui, K. Ozekin, H.W. Zhu, and C. Wang, (1998). Empirically Based Models for Predicting Chlorination and Ozonation By-Product: Haloacetic Acids, Chloral Hydrate, and Bromate. EPA Report CX 819579. USEPA Office of Groundwater and Drinking Water: Cincinnati, OH, 1998.

The modeling approach utilized and parameters assumed are those of CALFED and their consultants to carry out preliminary analysis on how various concepts could potentially affect water quality. Results from this modeling may differ from individual agency modeling projections. Individual agencies would be required to conduct more detailed studies before making conclusions about water quality effects, if there is continued interest in one or more concepts. Source water variations, operating complexities and potential treatment modifications would all be considered in more detailed analysis.

Data Presentation

The methods described above will be used to project DBP production for each agency, based on anticipated treatment processes and distribution system residence times. Projected maximum, minimum, and average values for each source and treated water parameter will be displayed in tabular and graphical format in the concept scorecards.

Data Presentation: Source Water Quality

Figures D-1 through D-3 represent the type of graphs to be developed for displaying source water quality. In addition to being displayed in tabular format, source water bromide, TOC, and TDS will also be displayed graphically. Figure D-1 displays source water bromide for a given agency and concept. The concept represented in this graph is one that provides water only in an average year. Therefore, Figure D-1

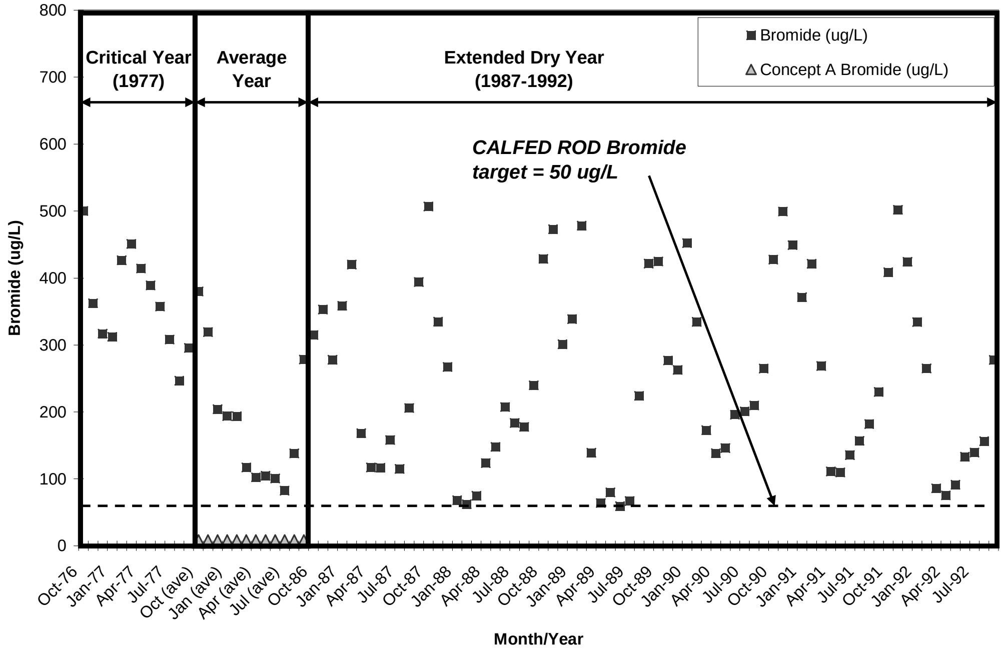

Figure D-1
Comparison of Agency A Baseline Bromide with Concept A Bromide

shows bromide data for Concept A in the average year portion of the chart only. Note that bromide is displayed in the context of the CALFED ROD bromide target of 50 µg/L. In this situation, both bromide variability and magnitude are projected to be significantly lower for example Concept A as compared with baseline.

Figure D-2 displays source water TOC for a given agency and concept. Again, Concept A TOC values are displayed for average year only, indicating that the concept is assumed to be operational only in average years. Note that, as with bromide, TOC is displayed in the context of its CALFED ROD target of 3.0 mg/L. In this situation, TOC variability and magnitude are also projected to be lower for Concept A than for baseline.

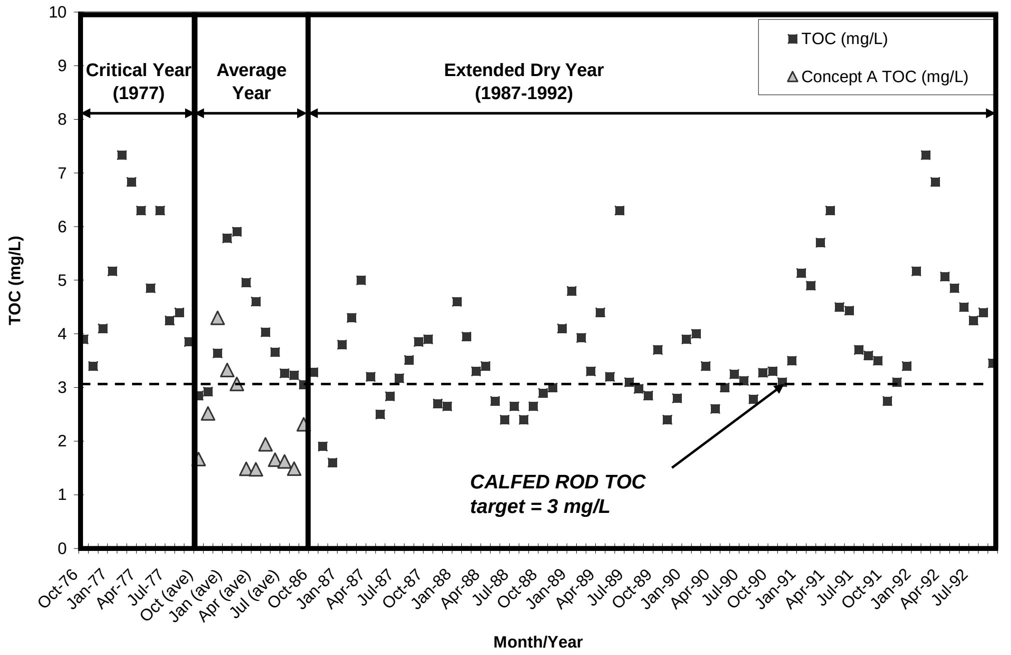

Figure D-2
Comparison of Agency A Baseline TOC with Concept A TOC

Figure D-3 displays source water TDS for the same example agency and concept. TDS variability and magnitude are also projected to be lower for example Concept A in average years compared to baseline.

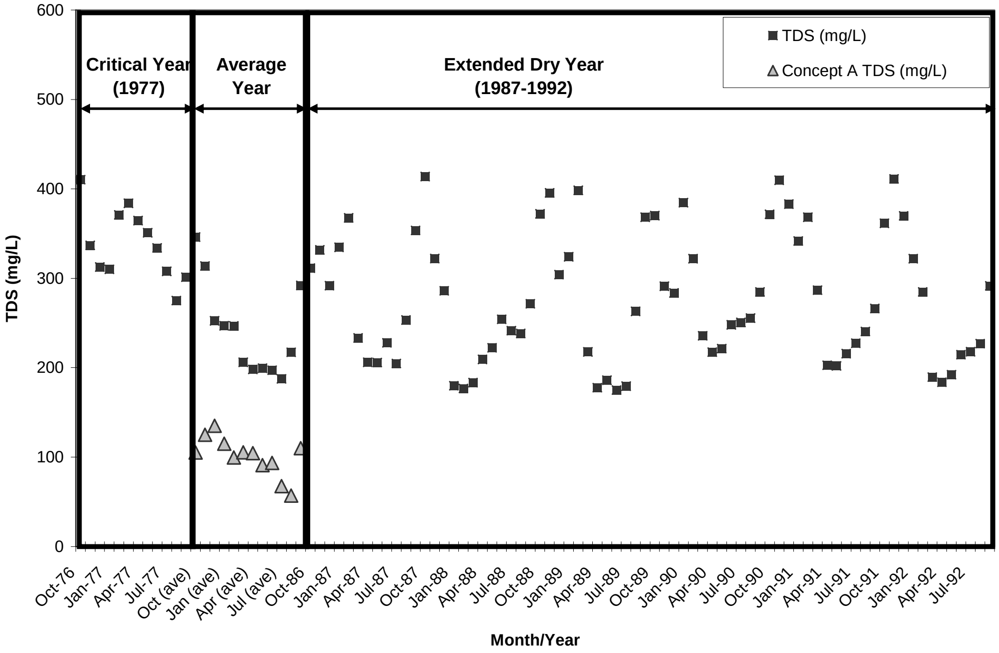

Figure D-3
Comparison of Agency A Baseline TDS with Concept A TDS

Data Presentation: Treated Water Quality

Figures D-4 through D-6 represent the type of graphs to be developed for displaying treated water quality. As with source water quality, treated water quality, including projected THM, HAA, and bromate production, will be displayed both in tabular format and graphically, with and without concept implementation.

Figure D-4 displays projected treated water THM concentrations for a given agency and concept. In addition, the quarterly running annual averages (RAAs) have been calculated for each data set, and have been graphed with the D/DBP Stage 2 target RAA of 80 µg/L. In this situation, the concept effects have been evaluated for all year types. Average point THM values, as well as variability and magnitude are projected to be slightly lower for example Concept A, with the effect most pronounced in critical dry years. However, it can be seen in Figure D-4 that Agency X critical year THM values without implementation of Concept A are projected to be significantly below the D/DBP Stage 2 regulatory target of 80 µg/L. The graphical presentation allows the significance of the potential reduction in THM formation to be considered in the appropriate context, that is in terms of the ability of Agency X to comply with existing and projected DBP regulations in all year types without concept implementation.

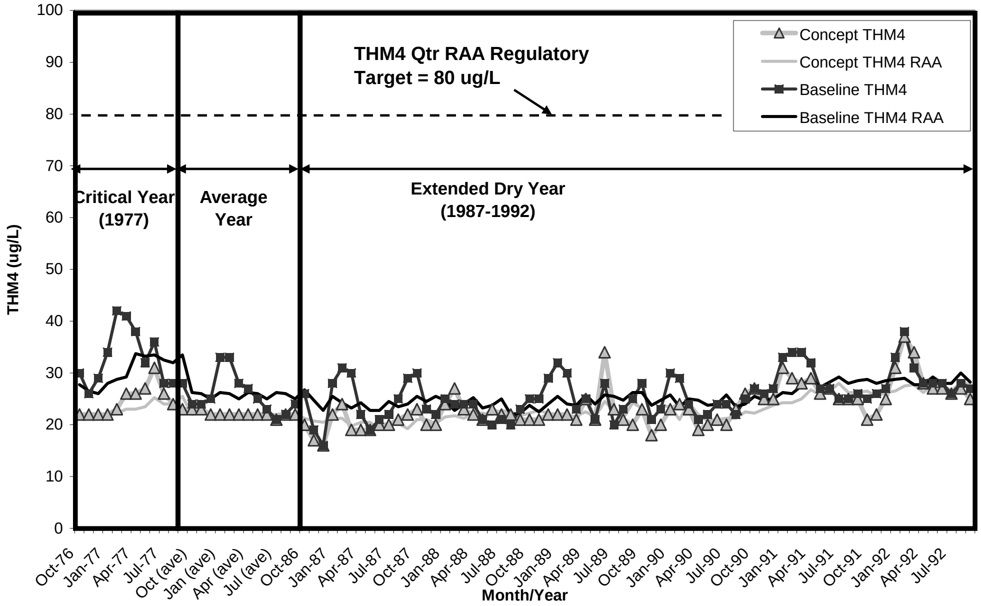

Figure D-4
Comparison of Agency A Baseline THM_4 with Concept A THM_4

Figure D-5 displays projected treated water HAA5 concentrations for a given agency and concept. As with the THM analysis, quarterly RAAs have been calculated for each HAA data set, and have been graphed with the D/DBP Stage 2 target RAA of 60 µg/L. As with the THM analysis, average point HAA variability and magnitude are projected to be slightly reduced by the potential implementation of example concept A in critical dry years and average years, with little improvement in extended dry year conditions. Again, however, Agency X critical and average year HAA values without implementation of Concept A are projected to be significantly below the D/DBP Stage 2 regulatory target of 60 µg/L. The graphical presentation again reveals the projected impact on HAA formation in the context of Agency X's ability to comply with existing and projected DBP regulations in all year types without concept implementation.

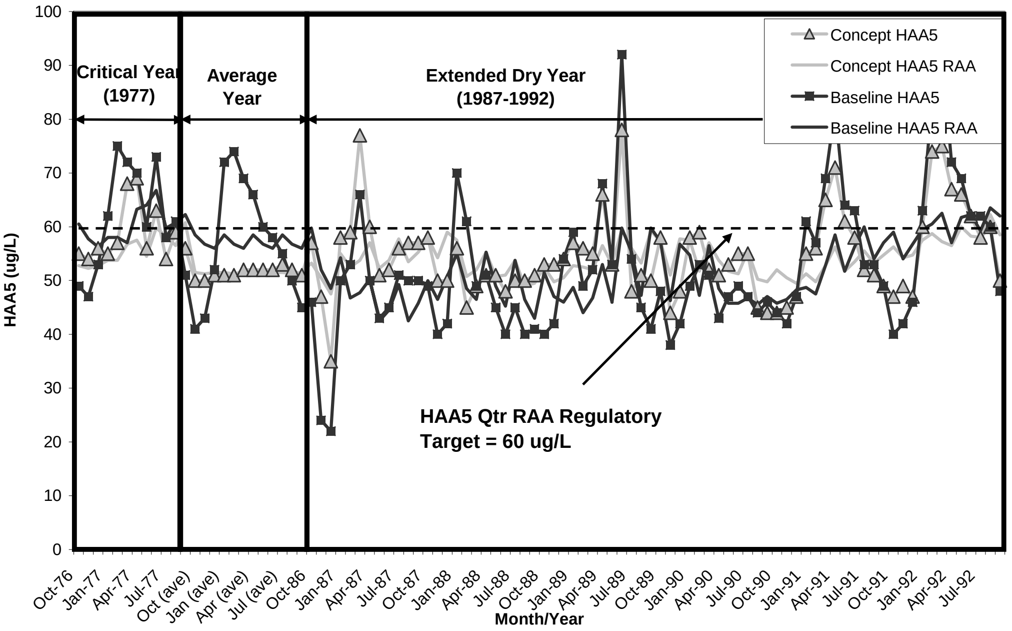

Figure D-5
Comparison of Agency A Baseline HAA_5 with Concept A HAA_5

Figure D-6 displays projected treated water bromate concentrations for Agency X and Concept A. Monthly RAAs have been calculated for each bromate data set, and have been graphed with the regulatory target RAA of 10 µg/L. Average point bromate variability is not projected to be significantly reduced with implementation of concept A. The magnitude of the RAA is projected to be slightly lower with concept A as compared to baseline in all year types. Again, the baseline monthly RAA is projected to remain below the regulatory target in all year types without implementation of Concept A, potentially reducing the significance of the reduction through concept implementation.

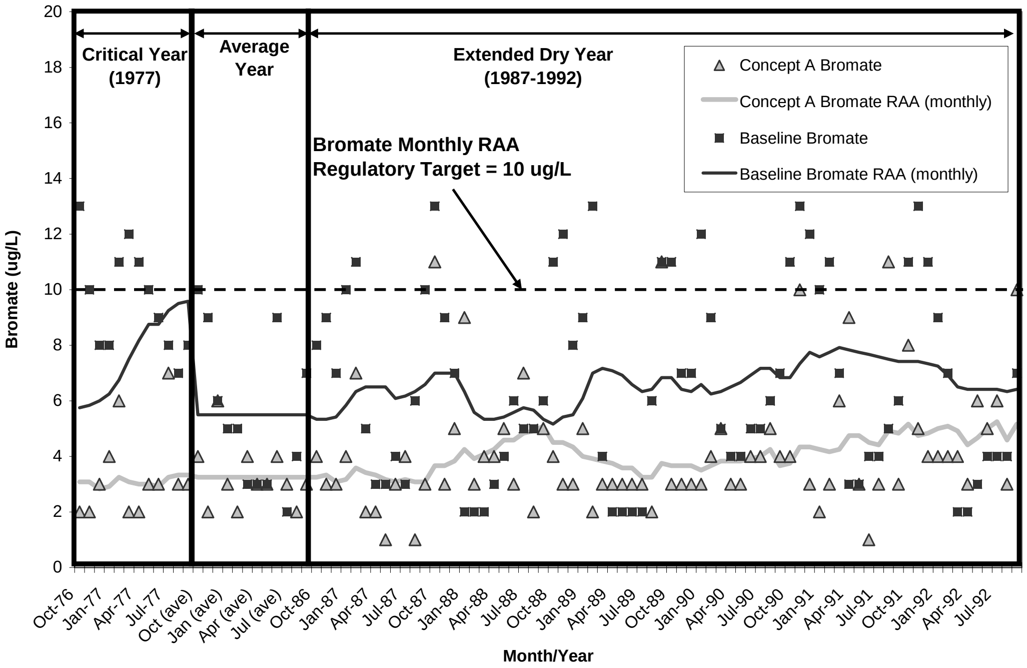

Figure D-6
Comparison of Agency A Baseline Bromate with Concept A Bromate

Appendix D.A
WTP Input Parameters

Agency: ACWD (Mission San Jose Water Treatment Plant)

Table D.A-1
ACWD Mission San Jose Water Treatment Plant (MSJWTP) Inputs

Process Step	***Parameter***	***Input Value***
Influent	All	(see Table A-8, Influent Parameters)
Ferric Addition	Ferric Dose	25 mg/L as $FeCl_3$ *6 H_2O
Sodium Hypochlorite Addition	Sodium Hypochlorite Dose	1.0 mg/L as Cl_2
Rapid Mix	Volume of Basin	0.004 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.5
Settling Basin	Volume of Basin	0.84 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.30
MF/UF	Percent Recovery	95%
	Giardia Log Removal by MF/UF	4.0 logs
	Virus Log Removal by MF/UF	4.0 logs
	Crypto Log Removal by MF/UF	4.0 logs
Sodium Hypochlorite Addition	Sodium Hypochlorite Dose	3.5 mg/L as Cl_2
Reservoir	Volume of Basin	0.075 MG
	Ratio of T50/Detention Time	1.0
	Ratio of T10/Detention Time	0.36
Ammonia Addition	Ammonia Dose	0.5 mg/L as N
Sodium Hydroxide Addition	Sodium Hydroxide Dose	15 mg/L as NaOH (effluent pH=9.3)
Average Tap	Residence time	0.7 Days

Agency: ACWD (Water Treatment Plant No. 2)

Table D.A-1
ACWD WTP2 Inputs

Process Step	***Parameter***	***Input Value***
Influent	All	(see Table A-8, Influent Parameters)
Carbon Dioxide Addition	Carbon Dioxide Dose	14.5 mg/L as CO_2
Alum Addition	Alum Dose	25.0 mg/L as $Al_2(SO_4)_3$*14 H_2O
Ozone Addition	Ozone Dose	1.7 mg/L as O_3
Ozone Chamber	Volume of Basin	0.019 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.70
Ozone Chamber	Volume of Basin	0.02 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.70
Ozone Chamber	Volume of Basin	0.016 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.70
Ozone Chamber	Volume of Basin	0.016 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.70
Ozone Chamber	Volume of Basin	0.016 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.70
Ferric Addition	Ferric Dose	14.6 mg/L as $FeCl_3$ *6 H_2O
Rapid Mix	Volume of Basin	0.07 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.10
Flocculation	Volume of Basin	0.5139 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.50
Settling Basin	Volume of Basin	1.1 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.50
Filtration	Liquid volume	0.5430 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.70
	Chlorinated backwash water?	TRUE
	Filter media (Anthracite/Sand or GAC)	A/S
	Crypto log removal by filters	0.00 logs
Sodium Hypochlorite Addition	Sodium Hypochlorite Dose	4.0 mg/L as Cl_2
Reservoir	Volume of Basin	0.073 MG
	Ratio of T50/Detention Time	1.0
	Ratio of T10/Detention Time	0.6
Sodium Hydroxide Addition	Sodium Hydroxide Dose	24.2 mg/L as NaOH (effluent pH=7.7)
Ammonia Addition	Ammonia Dose	0.5 mg/L as N
Average Tap	Residence time	1.7 Days

Agency: CCWD (Bollman)[3]

Table D.A-2
CCWD (Bollman) WTP Inputs

Process Step	Parameter	Input Value
Influent	All	(see Table A-8, Influent Parameters)
Alum Addition	Alum Dose	40.0 mg/L as $Al_2(SO_4)_3$*14 H_2O
Rapid Mix	Volume of Basin	0.001 Million Gallons (MG)
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.10
Flocculation	Volume of Basin	0.42 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.50
Settling Basin	Volume of Basin	0.0025 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.50
Ozone Addition	Ozone Dose	1.0 mg/L as O_3
Ozone Chamber	Volume of Basin	0.013 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.60
Filtration	Liquid volume	0.05 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.70
	Chlorinated backwash water?	TRUE
	Filter media (Anthracite/Sand or GAC)	GAC
	Crypto log removal by filters	3.00 logs
Sodium Hydroxide Addition	Sodium Hydroxide Dose	8.0 mg/L as NaOH (effluent pH=7.2)
Sodium Hypochlorite Addition	Sodium Hypochlorite Dose	2.7 mg/L as Cl_2
Reservoir	Volume of Basin	10 MG
	Ratio of T50/Detention Time	1.0
	Ratio of T10/Detention Time	0.5
Ammonia Addition	Ammonia Dose	0.4 mg/L as N
Average Tap	Residence time	7.0 Days

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[3] Assumed 75 percent flow through Bollman blended with 25 percent flow through Randall-Bold per CCWD's Water Treatment Plant Master Plan, 12/2003.

Agency: CCWD (Randall-Bold)[4]

Table D.A-3
CCWD (Randall-Bold) WTP Inputs

Process Step	***Parameter***	***Input Value***
Influent	All	(see Table A-8, Influent Parameters)
Ozone Addition	Ozone Dose	1.0 mg/L as O_3
Ozone Chamber	Volume of Basin	0.013 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.60
Alum Addition	Alum Dose	40.0 mg/L as $Al_2(SO_4)_3$*14 H_2O
Rapid Mix	Volume of Basin	0.001 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.10
Flocculation	Volume of Basin	0.42 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.50
Settling Basin	Volume of Basin	0.0025 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.50
Ozone Addition	Ozone Dose	0.83 mg/L as O_3
Ozone Chamber	Volume of Basin	0.013 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.60
Filtration	Liquid volume	0.05 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.70
	Chlorinated backwash water?	TRUE
	Filter media (Anthracite/Sand or GAC)	GAC
	Crypto log removal by filters	3.00 logs
Sodium Hydroxide Addition	Sodium Hydroxide Dose	14.8 mg/L as NaOH (effluent pH=8.0)
Chlorine Solution Addition	Sodium Hypochlorite Dose	2.0 mg/L as Cl_2
Reservoir	Volume of Basin	5 MG
	Ratio of T50/Detention Time	1.0
	Ratio of T10/Detention Time	0.5
Ammonia Addition	Ammonia Dose	0.4 mg/L as N
Average Tap	Residence time	7.0 Days

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[4] Assumed 75 percent flow through Bollman blended with 25 percent flow through Randall-Bold per CCWD's Water Treatment Plant Master Plan, 12/2003.

Agency: EBMUD

Table D.A-4
EBMUD WTP Inputs

Process Step	***Parameter***	***Input Value***
Influent	All	(see Table A-8, Influent Parameters)
Permanganate Addition	Permanganate Dose	1.0 mg/L as $KMnO_4$
Alum Addition	Alum Dose	40.0 mg/L as $Al_2(SO_4)_3$*14 H_2O
Rapid Mix	Volume of Basin	0.001 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.10
Flocculation	Volume of Basin	0.42 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.50
Settling Basin	Volume of Basin	0.0025 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.50
Ozone Addition	Ozone Dose	1.5 mg/L as O_3
Ozone Chamber	Volume of Basin	0.013 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.60
Filtration	Liquid volume	0.05 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.70
	Chlorinated backwash water?	TRUE
	Filter media (Anthracite/Sand or GAC)	A/S
	Crypto log removal by filters	3.00 logs
Sodium Hydroxide Addition	Sodium Hydroxide Dose	8.0 mg/L as NaOH (effluent pH=7.2)
Sodium Hypochlorite Addition	Sodium Hypochlorite Dose	2.0 mg/L as Cl_2
Reservoir	Volume of Basin	0.0015 MG
	Ratio of T50/Detention Time	1.0
	Ratio of T10/Detention Time	0.5
Ammonia Addition	Ammonia Dose	0.4 mg/L as N
Average Tap	Residence time	7.0 Days

Agency: SFPUC (Sunol Valley Water Treatment Plant)

Table D.A-5
SFPUC WTP Inputs

Process Step	***Parameter***	***Input Value***
Influent	All	(see Table A-8, Influent Parameters)
Permanganate Addition	Permanganate Dose	1.0 mg/L as $KMnO_4$
Alum Addition	Alum Dose	25.0 mg/L as $Al_2(SO_4)_3$*14 H_2O
Rapid Mix	Volume of Basin	0.001 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.10
Flocculation	Volume of Basin	0.42 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.50
Settling Basin	Volume of Basin	0.025 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.5
Sodium Hypochlorite Addition	Sodium Hypochlorite Dose	2.0 mg/L as Cl_2
Filtration	Liquid volume	0.017 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.70
	Chlorinated backwash water?	TRUE
	Filter media (Anthracite/Sand or GAC)	A/S
	Crypto log removal by filters	3.00 logs
Sodium Hydroxide Addition	Sodium Hydroxide Dose	10.0 mg/L as NaOH (effluent pH=8.3)
Reservoir	Volume of Basin	0.21 MG
	Ratio of T50/Detention Time	0.50
	Ratio of T10/Detention Time	0.10
Ammonia Addition	Ammonia Dose	0.4 mg/L as N
BDPLs	Residence time	1.0 Days

Agency: SCVWD

Table D.A-6
SCVWD WTP Inputs

Process Step	***Parameter***	***Input Value***
Influent	All	(see Table A-8, Influent Parameters)
Permanganate Addition	Permanganate Dose	1.0 mg/L as $KMnO_4$
Alum Addition	Alum Dose	40.0 mg/L as $Al_2(SO_4)_3$*14 H_2O
Rapid Mix	Volume of Basin	0.001 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.10
Flocculation	Volume of Basin	0.42 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.50
Settling Basin	Volume of Basin	0.0025 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.50
Ozone Addition	Ozone Dose	1.5 mg/L as O_3
Ozone Chamber	Volume of Basin	0.013 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.60
Filtration	Liquid volume	0.05 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.70
	Chlorinated backwash water?	TRUE
	Filter media (Anthracite/Sand or GAC)	A/S
	Crypto log removal by filters	3.00 logs
Sodium Hydroxide Addition	Sodium Hydroxide Dose	8.0 mg/L as NaOH (effluent pH=7.2)
Sodium Hypochlorite Addition	Sodium Hypochlorite Dose	2.0 mg/L as Cl_2
Reservoir	Volume of Basin	0.0015 MG
	Ratio of T50/Detention Time	1.0
	Ratio of T10/Detention Time	0.5
Ammonia Addition	Ammonia Dose	0.4 mg/L as N
Average Tap	Residence time	7.0 Days

Agency: Zone 7 (Del Valle Water Treatment Plant)

Table D.A-7
Zone 7 WTP Inputs

Process Step	***Parameter***	***Input Value***
Influent	All	(see Table A-8, Influent Parameters)
Ferric Addition	Ferric Dose	15 mg/L as $FeCl_3*6H_2O$
Sodium Hypochlorite	Sodium Hypochlorite Dose	1.0 mg/L as Cl2
Rapid Mix	Volume of Basin	0.001 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.10
Flocculation	Volume of Basin	0.42 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.30
Settling Basin	Volume of Basin	1.2 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.30
Sodium Hypochlorite Addition	Sodium Hypochlorite Dose	2.0 mg/L as Cl_2
Filtration	Liquid volume	0.23 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.70
	Chlorinated backwash water?	TRUE
	Filter media (Anthracite/Sand or GAC)	A/S
	Crypto log removal by filters	3.00 logs
Sodium Hydroxide Addition	Sodium Hydroxide Dose	2.0 mg/L as NaOH (effluent pH=7.7)
Ammonia Addition	Ammonia Dose	0.4 mg/L as N
Average Tap	Residence time	3.0 Days

Agency: Zone 7 (Patterson Pass Water Treatment Plant – Conventional Train)[5]

Table D.A-8
Zone 7 WTP Inputs

Process Step	***Parameter***	***Input Value***
Influent	All	(see Table A-8, Influent Parameters)
Ferric Addition	Ferric Dose	15 mg/L as $FeCl_3$ *6 H_2O
Sodium Hypochlorite	Sodium Hypochlorite Dose	1.0 mg/L as Cl2
Rapid Mix	Volume of Basin	0.001 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.10
Flocculation	Volume of Basin	0.015 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.30
Settling Basin	Volume of Basin	0.48 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.30
Sodium Hypochlorite Addition	Sodium Hypochlorite Dose	2.0 mg/L as Cl_2
Filtration	Liquid volume	0.09 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.70
	Chlorinated backwash water?	TRUE
	Filter media (Anthracite/Sand or GAC)	A/S
	Crypto log removal by filters	3.00 logs
Sodium Hydroxide Addition	Sodium Hydroxide Dose	2.0 mg/L as NaOH (effluent pH=7.7)
Ammonia Addition	Ammonia Dose	0.4 mg/L as N
Average Tap	Residence time	3.0 Days

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[5] Assumes 80 percent of flow through conventional train and 20 percent of flow through ultrafiltration train of Patterson Pass Water Treatment Plant.

Agency: Zone 7 (Patterson Pass Water Treatment Plant – Ultrafiltration Train[6])

Table D.A-9
Zone 7 WTP Inputs

Process Step	***Parameter***	***Input Value***
Influent	All	(see Table A-8, Influent Parameters)
Ferric Addition	Ferric Dose	15 mg/L as $FeCl_3$ *6 H_2O
Sodium Hypochlorite	Sodium Hypochlorite Dose	1.0 mg/L as Cl2
Rapid Mix	Volume of Basin	0.001 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.10
Flocculation	Volume of Basin	0.01 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.30
Settling Basin	Volume of Basin	0.287 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.30
MF/UF	Percent Recovery	90%
	Giardia Log Removal by MF/UF	3.0 logs
	Virus Log Removal by MF/UF	2.0 logs
	Crypto Log Removal by MF/UF	2.0 logs
Sodium Hypochlorite Addition	Sodium Hypochlorite Dose	2.0 mg/L as Cl_2
Reservoir	Volume of Basin	0.0200 MG
	Ratio of T50/Detention Time	1.00
	Ratio of T10/Detention Time	0.30
Sodium Hydroxide Addition	Sodium Hydroxide Dose	2.0 mg/L as NaOH (effluent pH=7.7)
Ammonia Addition	Ammonia Dose	0.4 mg/L as N
Average Tap	Residence time	3.0 Days

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[6] Assumes 80 percent of flow through conventional train and 20 percent of flow through ultrafiltration train of Patterson Pass Water Treatment Plant.

Influent Parameters

Table D.A-10
WTP Influent Parameters

Parameter	***Input Value***
pH	7.9
Temperature	17.6 C
Minimum temperature	5.0 C
TOC	variable
UVA	0.129 cm^{-1}
Bromide	variable
Alkalinity	95 mg/L as $CaCO_3$
Calcium hardness	100 as $CaCO_3$
Total hardness	125 as $CaCO_3$
Ammonia	0 mg/L as N
Turbidity	9.3 NTU
Cryptosporidium removal inactivation required	3.0 logs
Multiplier for crypto CT by ClO_2	7.5
Peak flow	variable

Appendix E

Descriptions of Concepts Evaluated in BAWQ&SRP

Appendix E
Descriptions of Concepts Evaluated in BAWQ&SRP

E1	Calaveras Reservoir Expansion Concept
E2	Los Vaqueros Reservoir Expansion Concept
E3	Recycled Water Concept
E4	Regional Desalination Project
E5	Bay Area Use of the Freeport Regional Water Project
E6	Enhanced Water Conservation Concept

E1. Calaveras Reservoir Expansion Concept

Appendix E1
Calaveras Reservoir Expansion Concept

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Appendix E1
Calaveras Reservoir Expansion Concept

1.0 Concept Overview

1.1 Description

The Calaveras Reservoir Expansion could potentially involve an increase in capacity from the existing size of 97,000 acre-feet (AF) to 420,000 AF. The California Division of Safety of Dams has identified potential seismic concerns with the existing dam. A San Francisco Public Utilities Commission (SFPUC) study is currently looking at alternatives for replacement of the dam, including: replacement at the existing capacity of 97,000 AF, and initial construction at 97,000 AF with the ability to expand in the future up to 420,000 AF.

Calaveras Reservoir Expansion
Extended Dry Year Supply ………………53,000 AFY
Average Year Water Quality Supply up to 55,000 AFY

Cost
Capital Cost ....$426M (2003 dollars)
O&M Cost .... TBD in future studies
Unit Cost .... TBD in future studies

Owning Agency: SFPUC

Potential Partners/Beneficiaries: (1)
Dry Year Supply - SFPUC, SCVWD, ACWD, BAWSCA
Dry Year Water Quality - ACWD, SCVWD
Average Year Water Quality – ACWD, SCVWD

(1) BAWSCA (including ACWD) would be beneficiaries as part of the SFPUC regional system. For the purposes of this study, SFPUC includes retail customers and the 28 wholesale customers,

This study is considering regional concepts to expand the reservoir. The regional concepts would entail a regional partnership to expand of the reservoir up to 420,000 AF, with operation to provide water quality and/or supply reliability benefits to regional participants. The regional concepts described in this write-up do not represent a future operating scenario endorsed by the SFPUC nor do they represent a complete characterization of all facilities that may be required. In addition, no specific analysis was performed to ascertain availability of SFPUC water for the regional concepts described.

With expansion to 420,000 AF, there are two primary operating options that are being evaluated in this study. With the first option, the additional storage of 323,000 AF (420,000 AF less 97,000 AF) is kept full the majority of the time, operating only the 97,000 AF to provide SFPUC's existing local supply needs. The additional capacity could then provide additional dry year supply reliability for potential partners, and would require use of Hetch Hetchy system or another source of supply to initially fill the expanded storage, and re-fill it following a drought. This additional stored water could be conveyed to meet SFPUC (including San Francisco retail and wholesale customers, BAWSCA member agencies) demands through the existing SFPUC transmission facilities. Flows could also be conveyed to the SCVWD/SFPUC common customers through increasing existing SFPUC deliveries directly to these customers or providing water directly to the SCWVD through the existing emergency intertie to meet the District's overall water needs. Another alternative for delivery would be to transfer these flows into the South Bay Aqueduct in the Sunol Valley.

This alternative would also provide dry year water quality improvements for ACWD and SCVWD.

The second option would be to transfer Hetch Hetchy water or another source of supply into the expanded Calaveras Reservoir in average and wet years, and deliver this water to the South Bay Aqueduct to provide an average year water quality benefit for the downstream SBA contractors ACWD and SCVWD. By providing this water quality benefit, the Calaveras Reservoir would be drawn down at the beginning of a dry period, thus reducing the potential dry year supply yield.

1.2 Potential Partners and Supply Amounts

Table E1-1 summarizes potential dry year supply and average year water quality partners for the enlarged Calaveras Reservoir concept.

Table E1-1
Potential Partners and Supply Amounts

Agency	*Type of Benefit*	*Potential Amount (AFY)*	*Notes/Issues*
SFPUC(1)(2), BAWSCA	Dry year supply	up to 53,000	Dry year supply would apply to SFPUC retail (City and County of San Francisco) and wholesale customers (BAWSCA)
ACWD, SCVWD(2)(3)	Dry year supply	up to 53,000	Possibility to provide dry year supply storage for the SCVWD/SFPUC common customers and possibly others. This option could also provide dry year water quality benefits to both ACWD and SCVWD if the supply was distributed into the South Bay Aqueduct.
ACWD, SCVWD	Average Year Water Quality	up to 50,000	Assumes up to 50,000 AF/yr is transferred into Calaveras Reservoir to be delivered to the SBA under average year hydrologic conditions for water quality improvement. This would also reduce the dry year supply yield from up to 53,000 AFY to approximately 41,000 AFY.

(1) For the purposes of this study, SFPUC includes retail customers and the 28 wholesale customers, BAWSCA member agencies.

(2) The up to 53,000 AFY dry year supply is a total for all partners. The actual allocation to each partner will vary depending on the operating agreements, but would not exceed 53,000 AFY. The dry year supply for SFPUC provides regional dry year supply benefits the SFPUC retail customers, and BAWSCA. The common SCVWD and SFPUC customers would also benefit.

(3) This dry year supply could apply to ACWD and only the SCVWD and SFPUC common customers, or to ACWD and possibly other service areas within SCVWD. However, additional supply sources would be required under both conditions.

Dry-Year Supply

SFPUC, including the retail and wholesale customers (BAWSCA member agencies), would be a potential recipient of water for dry-year supply reliability. SCVWD and ACWD are also potential dry year supply customers. If the enlarged reservoir is used primarily for supply reliability, the estimated additional dry year supply could be up to 53,000 AF per year (AFY) for all agencies. This is based on allocating the additional 323,000 AF equally over a five (5) year drought period, including estimated losses for evaporation. The estimated dry year supply is a total for all partners. The actual allocation to each partner agency may vary depending on the operating agreements, but would most likely not exceed 53,000 AFY.

If the dry year supply portion provided to SCVWD is conveyed through the South Bay Aqueduct (SBA) then both SCVWD and ACWD would receive water quality benefits by improving the overall water quality delivered to them through the SBA. That water quality improvement would be greatest if the discharges to the SBA were to occur during the summer and fall when the SBA water quality, especially during dry years, is poorer.

Average Year Water Quality

A portion of the approximately 320,000 AF in additional storage capacity could potentially be used to store water transferred to the reservoir during the winter months, and then delivered into the SBA during the summer or fall months when the water quality in the SBA is poorer. One of the impacts of using a portion of the expanded storage for water quality benefits is that storage is reduced at the beginning of the following year. If subsequent years have below normal hydrology, then the dry year supply yield is reduced. Based on analysis of several years of operating data, an average annual use of 50,000 AF for water quality improvement is considered feasible. However, that use in normal years will reduce the dry year yield from approximately 53,000 AF to 41,000 AF. The basis for these quantities is more fully discussed in Section 2.

Other Partners Considered but Not Included

No other potential partners were considered.

1.3 Operating Description

The existing SFPUC system is not currently configured to allow transfer of Hetch Hetchy supply to the Calaveras Reservoir. Water can be taken from the reservoir to the Sunol Valley Water Treatment Plant (SVWTP) through the Calaveras Pipeline, or transferred to the San Antonio Reservoir. Flows to the SVWTP from the Calaveras Reservoir normally occur during the summer to help meet system summer peak demands. Transfers to San Antonio Reservoir occur when the Calaveras Reservoir might spill during the winter or spring, and when the water level in the San Antonio Reservoir is low enough to accept the transfers.

In order to transfer water into the reservoir, a new pumping plant and pipelines would be required. Also, with the enlargement the existing Calaveras Reservoir, the existing pipelines would need to be replaced due to the higher head conditions from the enlarged reservoir, or pressure reducing stations would have to be constructed to reduce the pressures to within the existing pipeline design pressure rating.

With the enlargement of the Calaveras Reservoir, reservoir operation could be modified to allow transfer of Hetch Hetchy supply and/or other sources of water to be conveyed through the SFPUC San Joaquin Pipelines (SJPL) into the expanded Calaveras Reservoir. This transfer would normally occur during the lower demand winter and spring months when there is potentially capacity available in the San Joaquin Pipelines to transfer water.

Under the dry-year supply operational scenario, the reservoir would be filled and maintained close to full storage in anticipation of future dry hydrologic periods, or extended dry periods. This water would then be withdrawn to meet those dry year period supply needs over 5 or 6 years, and then re-filled over several years after normal hydrologic conditions return. The dry year supply could be conveyed to SCVWD through the existing intertie, or through discharge into the SBA.

For the average water quality operational scenario, transfers would be similar to the dry-year supply scenario, with transfers to storage occurring during winter and spring months of average and wet hydrologic years. Some of this water could then be delivered during normal hydrologic years into the South Bay Aqueduct (SBA) to improve overall water quality in the SBA. Deliveries would normally occur during the summer and fall months when the water quality in the SBA is poorer. Operation to improve average water quality in the SBA would result in reduction in the dry-year water supply reliability from approximately 53,000 AFY to 41,000 AFY. This is due to the reduction in total Calaveras Reservoir storage at the end of each year caused by the withdrawals for water quality.

2.0 Project Facilities

Figure E1-1 and Table E1-2 summarize the proposed facilities for this concept.

2.1 Basis for Facility Sizing

The potential sizing for the dry-year supply and average year water quality operational scenarios is a function of both the best expansion size for the reservoir, and the capacity to transfer water into and out of the Calaveras Reservoir. The maximum storage capacity of 420,000 AF is based on considerations of the active Calaveras fault, which passes through a low saddle west of the dam site, and limits the maximum reservoir level. It is not considered feasible to construct a saddle dam across the active Calaveras fault. The other basis for facility sizing is the hydraulic capacity of the San Joaquin Pipelines and the Coast Range Tunnel, and the potential capacity available in these facilities during the lower demand and flow months of winter and spring to transfer water into the Calaveras Reservoir.

The historic operation of the San Joaquin Pipelines was analyzed to estimate potential available capacity during the winter and spring months for transfer of flows through the San Joaquin Pipelines to an expanded Calaveras Reservoir. Transfer rates of 50, 100, and 150 MGD were evaluated during winter months for 1992 to 1998, which represent a range of annual conditions approaching average hydrologic flows.

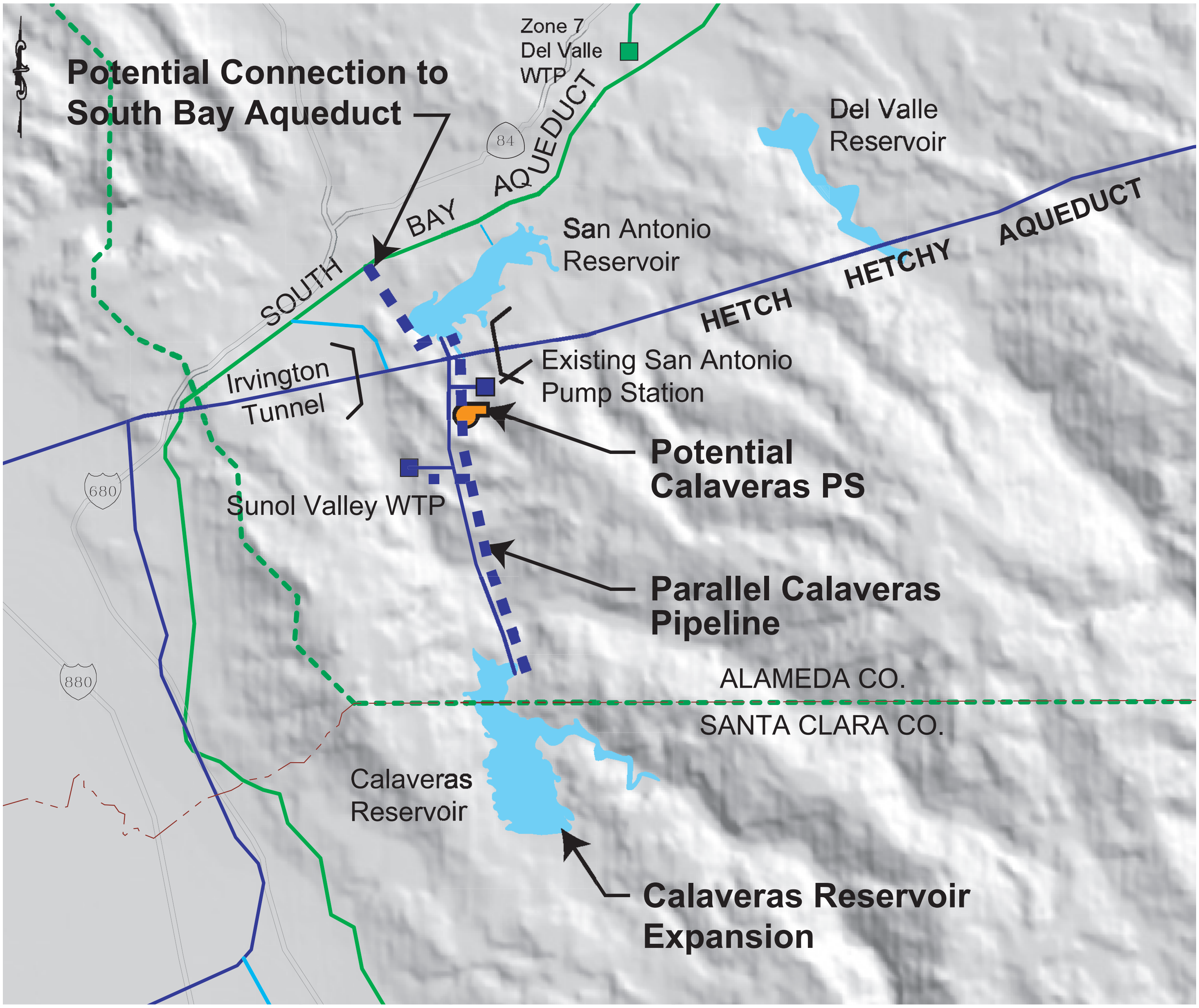

Figure E1-1
Calaveras Reservoir Expansion
420,000 Acre-Feet

Table E1-2

Project Facilities for Expanded Calaveras Concept

Facility	***Notes***
Dry Year Supply Operation	
Dam • New dam, spillway, inlet/outlet facilities	It is assumed that the reservoir capacity is expanded to approximately 420,000 AF. Only 323,000 AF is assumed available for potential regional projects.
Pipelines • New pipeline from Calaveras Reservoir to the Sunol Valley Water Treatment Plant	New pipelines or a pressure reducing station are required due to the higher system pressure from the higher water surface elevation in the expanded reservoir.
• New pipeline from the Sunol Valley Water Treatment Plant to the new Calaveras Pump Station.	New pipelines or a pressure reducing station are required due to the higher system pressure from the higher water surface elevation in the expanded reservoir.
Pump Station • New Calaveras Pump Station	Assumed to be located in the vicinity of the San Antonio Pump Station.
Water Quality Operation	
Dam • New dam, spillway, inlet/outlet facilities	It is assumed that the reservoir capacity is expanded to approximately 420,000 AF. Only 323,000 AF is assumed available for potential regional projects.
Pipelines • New pipeline from Calaveras Reservoir to the Sunol Valley Water Treatment Plant	New pipelines or a pressure reducing station are required due to the higher system pressure from the higher water surface elevation in the expanded reservoir.
• New pipeline from the Sunol Valley Water Treatment Plant to the new Calaveras Pump Station.	New pipelines or a pressure reducing station are required due to the higher system pressure from the higher water surface elevation in the expanded reservoir.
• New pipeline and connection to the South Bay Aqueduct.	New pipelines or a pressure reducing station are required due to the higher system pressure from the higher water surface elevation in the expanded reservoir.
• Pressure Reducing Station at SBA	The maximum grade of the expanded reservoir is 900 feet versus 650 feet for the HGL of the SBA. This facility could be located at the new Calaveras PS, or at the SBA connection.
Pump Station • New Calaveras Pump Station	Assumed to be located in the vicinity of the San Antonio Pump Station.

Table E1-3 summarizes the potential annual transfers at the three transfer rates. Annual transfers were computed assuming all transfers to the reservoir are made during the six month period from October through May. As Table E1-3 shows, with a transfer rate of 50 MGD, the total volume that can be transferred during this period ranges from 36,700 AF to 37,300 AF (approximately equal to the maximum transfer rate, maintained over the six-month period). As the transfer rate increases, the annual transfers increase, but at a lesser rate, as the capacity in the San Joaquin Pipelines becomes the constraint. The data used to prepare the estimates of the transfer rates is based on review of historical operation, analysis of maximum hydraulic capacity, and potential changes in future operation based on review comments and discussions with SFPUC staff.

Table E1-3
Potential Annual Transfers to Expanded Calaveras Reservoir

Transfer Rate [(1)] (MGD)	***Annual Transfers (AFY)***		
	Min.	***Average***	***Max.***
50	36,900	37,200	37,300
100	63,400	68,100	71,300
150	81,300	90,200	99,500

(1) Based on transfers from October through May, and available Hetch Hetchy system capacity for 1992-1998

Based on a maximum transfer rate of 100 MGD it would take about five years to fill the 323,000 AF proposed operational capacity after an extended dry period such as 1987 to 1992.

Under the water quality operational scenario, a certain amount of water would be transferred into the Calaveras Reservoir during the winter and spring, and then released to the South Bay Aqueduct during the poorer water quality months of summer and fall. Table E1-4 shows the flow rate and number of months required to transfer flow into an expanded Calaveras Reservoir in order to refill the reservoir to meet three different water quality storage goals. As indicated in Table E1-4, with a 100 MGD maximum transfer rate, it would take about three months to refill the reservoir by 25,000 AF, and 5.5 months to refill 50,000 AF. Based on the information presented in Table D1-3, 50,000 AF is likely a feasible volume to refill each year during average hydrologic conditions. Based on available transfer capacity it would be very difficult to withdraw and refill 100,000 AF per year, even at 150 MGD. For the purposes of this analysis we have assumed that the annual water quality withdrawal is 50,000 AF.

Table E1-4
Transfer Rate Required for Varying Annual Water Quality Storage

Water Quality Storage Volume (AF)	Pumping Rate (MGD)	Number of Months for Transfer
25,000	50	5.5
25,000	100	3
25,000	150	2
50,000	50	11
50,000	100	5.5
50,000	150	4
100,000	50	22
100,000	100	11
100,000	150	7

With annual use for water quality benefits to the South Bay Aqueduct, the reservoir storage will be drawn down by 50,000 AF at the beginning of each winter season. If the following years are drier than normal, there will be less water stored for dry year supply than if there were no withdrawal for water quality. Table E1-5 indicates the reduction in dry year yield with different annual withdrawal quantities for SBA water quality improvement. As indicated in Table E1-5, with annual water quality withdrawal of 50,000 AF during average hydrologic conditions, the dry year yield would be reduced from 53,000 AF to approximately 41,000 AF. These yields are based on an assumed 5 year drought.

Table E1-5
Reduction in Dry Year Yield with Increasing Annual Withdrawal for SBA Water Quality Improvement

Annual WQ Withdrawal (AF)	Annual Dry Year Yield (1) (AF)
-	53,000
25,000	46,000
50,000	**41,000**
100,000	32,000
150,000	22,400

(1) Based on a 5 year drought.

3.0 Engineering Analysis

This section provides an analysis of the engineering aspects of the project that will be assessed in the detailed concept and portfolio evaluation (the "scorecard"). Where information is currently available it has been included in the following sections. However, much of the scorecard data will be developed after agreement on the concepts.

3.1 Project Costs

The facility sizing has been based on the assumption of a 100 MGD transfer capacity into an expanded Calaveras Reservoir, and withdrawal rates of 75 to 100 MGD. Based on a maximum pipeline velocity of 7 feet per second and 100 MGD capacity, the new pipeline would have a diameter of approximately 64 inches. The required pump station horsepower for a 100 MGD capacity pipeline is approximately 14,900 HP.

Table E1-6 summarizes project capital, operating and annualized costs. These costs are preliminary, and will be updated after review by the SFPUC. Line items have been included indicating the major components. It should be noted that these costs do not include any costs associated with securing the additional water to be transferred into the expanded reservoir.

Basis for Cost Estimates

The estimate of costs for the dam enlargement is based on the Contingency Action Plan for Calaveras Dam Evaluations (URS, 2003). This cost is currently being updated for the SFPUC as part of the Calaveras Dam Conceptual Engineering Report.

Mitigation costs would vary depending on the actual mitigation strategy developed in consultation with the regulatory agencies. Restoration and creation of habitat would cost more if it occurred within mitigation bank(s) rather than on property already managed by SFPUC. For the purposes of this analysis, mitigation costs are estimated to be up to five percent of the total capital cost.

Table E1-6
Estimated Project Costs

Description	***Diameter (in)***	***Length (ft)***	***Horsepower (hp)***	***Cost ($million)***
Capital Costs				
New Dam, spillway, outlet works (1)	-	-	-	$355
Pipeline from Reservoir to SVWTP	76	21,500	-	$33
Pipeline from SVWTP to Calaveras PS (Assumed near SAPS)	64	8,900	-	$11
Pipeline from Calaveras PS to SBA	64	7,600	-	$9
New pump station		-	14,700	$18
Power for new pump station	-	-	-	$5
Pressure Reducing Station at SBA	-	-	-	$2
Total Capital Cost (2003)				$433
Operating Costs (annual)				
Cost of water (for water quality transfer)				TBD(2)
Pumping Cost				$3.5
Total Operating Cost				TBD(2)
Annual Costs				
Annualized Capital Costs				TBD(2)
Operating Costs				TBD(2)
Total Annual Cost				TBD(2)

(1) Based on Contingency Action Plan for Calaveras Dam Evaluations (URS, January 2003)
(2) To be determined as part of future studies

3.2 System Vulnerability

Providing increased storage in the Sunol Valley provides the SFPUC with additional flexibility to address maintenance outages in the conveyance facilities from the Sunol Valley eastward, including the Foothill Tunnel, San Joaquin Pipelines, and the tunnels between Oakdale Portal and Moccasin Reservoir. It also provides additional flexibility to deal with upstream water quality excursions.

The dam replacement and improvements in the Sunol Valley will be designed to withstand a seismic event on the Calaveras fault and will reduce the vulnerability to seismic events along the fault. The expansion and improvements in the valley do not reduce vulnerability to downstream system failures along the Irvington Tunnel and Bay Division Pipelines due to major seismic events along either Hayward or San Andreas earthquake faults.

3.3 Supply Reliability

An expanded Calaveras Reservoir increases supply reliability by providing up to an additional 320,000 AF of storage that could be used during a drought. Depending on how the storage is operated, both prior to drought periods and during a drought, the increase in total yield could be as high as 53,000 AF per year. However, if the reservoir is also used to provide water quality benefits to the South Bay Aqueduct, the annual yield is reduced to about 41,000 AF based on assumption of 50,000 AFY used during normal hydrologic years for water quality improvement to customers on the SBA.

3.4 Water Quality

Water quality during average year conditions for the SBA contractors would generally be more uniform, with lower levels of chloride, bromide, and TDS during the summer months as the releases are blended with other flows in the SBA. The actual improvement is dependent on the blend ratios between the SBA flows and the releases from Calaveras Reservoir, and the time of year when the releases are made. The downstream SBA contractors include Alameda County Water District and the Santa Clara Valley Water District.

During the operation to meet dry year supply needs both SCVWD and ACWD would receive water quality improvements if the dry year supply is transferred through the SBA.

3.5 Schedule

A schedule will be developed as the project is further defined in separate studies.

4.0 Environmental Analysis

This section summarizes the environmental analysis for this concept for the general environmental categories that will be presented in the detailed concept and portfolio evaluation (the "scorecard"). A more comprehensive environmental summary is included as Appendix A. Any potential environmental impacts and proposed mitigations presented here are those of CALFED and their consultants.

4.1 Potential Environmental Benefits

Environmental benefits are defined as an overall improvement to some aspect of environmental quality, to the land, air, or water. If the Maximize Water Quality option of this concept is selected, the concept has the potential to reduce Delta fisheries impacts, as it would reduce pumping during the normal and wet years.

4.2 Potential Environmental Impacts

Environmental impacts are defined as degradation in the quality of the environment that will likely require mitigation. Table E1-7 summarizes potential environmental impacts of the project, identifying the issue area, impacts and mitigation opportunities for aquatic resources, terrestrial resources, wetlands and energy consumption. Other potential environmental impacts, including but not limited to land use and construction-related effects, are discussed in Appendix A.

Table E1-7
Summary of Potential Environmental Impacts

Issue Area	***Potential Impacts***	***Mitigation Opportunities***
Aquatic Resources	Reservoir expansion could affect upstream perennial and intermittent streams, including Arroyo Hondo and Calaveras Creek. Tributary streams contain native and non-native warmwater fishery resources (minnows, suckers, catfish, bass, and sunfish). Sensitive fishery resources include: anadromous steelhead trout, resident rainbow trout, and native non-game fish. Project may affect steelhead restoration within the Alameda Creek Watershed (EDAW, 2004).	Identify acreage of aquatic resources affected through habitat assessments, and restore resources in and around the watershed at a ration deemed appropriate by regulatory agencies (this would require consultation with regulatory agencies, acquisition of permits, and compliance with permit conditions). Continue trout planting.
Biological Resources (Terrestrial)	Direct effects from inundation of terrestrial habitat including, but not limited to, non-native grassland; marsh; mixed evergreen forest / coast live oak woodland, Northern coastal scrub; pond; central coast arroyo willow and white alder riparian forest; blue oak woodland; sycamore alluvial woodland; valley oak woodland; and cultivated land) (EDAW, 2004). Highly sensitive communities include: Valley oak woodland, riparian forest, sycamore alluvial woodland, marsh, and area of potential serpentine associated plants. Additional disturbed acreage associated with construction of pipeline, pump station, regulating / hydroelectric station (EDAW, 2004). Potential effects to species associated with the above identified habitat, including but not limited to seven species that have formal listings as endangered or threatened (in 1998): Bay checkerspot butterfly, Callipe silverspot butterfly, myrtle silverspot butterfly, California red-legged frog, Alameda whipsnake, Aleutian Canada goose, and bald eagle.	Unavoidable Implement a mitigation strategy that provides for resource restoration or enhancement, in and around the watershed. Conduct habitat assessments and sensitive species surveys. Consult with regulatory agencies; acquire relevant permits; implement permit conditions, which may include habitat restoration at a 3:1 ratio (actual ratio determined by negotiations with regulatory agencies) if permanent impact occurs.
Wetlands	Total direct effects to wetland resources (marsh) from inundation.	Unavoidable Conduct wetland delineations. Consult with regulatory agencies; acquire relevant permits; implement permit conditions, which may include habitat restoration at a 3:1 ratio (actual ratio determined by negotiations with regulatory agencies) if permanent impact occurs.
Energy	Operation of the pump station would require consumption of nonrenewable energy. Energy Consumption: TBD	Further evaluation would be required to determine the level of impact and mitigation opportunities.

5.0 Regulatory and Institutional Analysis

This section summarizes the regulatory and institutional evaluation for this concept for the general categories that will be assessed in the detailed concept and portfolio evaluation (the "scorecard").

5.1 Permitting

Due to the long-term effects of inundation, surface water reservoir projects require a number permits from agencies with jurisdiction over the sensitive biological resources, including the U.S. Army Corps of Engineers, California Department of Fish and Game, Regional Water Quality Control Board, and U.S. Fish and Wildlife Service. In addition, the California Division of Safety of Dams reviews plans and specifications for the construction of new dams or for the enlargement, alteration, repair, or removal of existing dams.

Certain permits and consultation (i.e., from USFWS) may lengthen the implementation schedule and increase the mitigation costs. The implementation schedule of the proposed concept cannot be determined at this time. The combined CEQA / NEPA compliance and permitting process may take a couple of years, to conduct the environmental review, surveys needed to characterize the site, and negotiations with regulatory agencies. The implementation schedule could be streamlined if the CEQA / NEPA and permitting processes are conducted concurrently; however, that requires development of engineering and design details for submittal to regulatory agencies. As limited information has been developed for this expansion, a parallel permitting and CEQA / NEPA effort may not be feasible.

5.2 Institutional Issues

The potential participating agencies (SFPUC, BAWSCA, ACWD, and SCVWD) would be required to prepare and individually adopt joint agreements (i.e., Memorandum of Understanding, Memorandum of Agreement, and Operations Agreement) outlining individual agencies' commitment to fund (capital costs, operations and maintenance costs), and operate the project. The operations agreement would include, but not be limited to, discussions of individual agencies' responsibilities for operation of the joint facilities, the quantity of water allocated to each party, and the timing such deliveries would occur. If the Calaveras Expansion were to go forward, changes to ACWD's water supply downstream would also need to be considered.

References

EDAW, 2004. Analysis by EDAW for the Bay Area Regional Water Quality and Supply Reliability Program.

Environmental Science Associates. Alameda Watershed Management Plan, Draft Environmental Impact Report, January 31, 2000. Prepared for the San Francisco Public Utilities Commission Planning Department, 2000.

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URS Corporation, 2003, Contingency Action Plan for Calaveras Dam Evaluations.

URS Corporation, 2004. Confirmation of assumptions by URS for the Bay Area Regional Water Quality and Supply Reliability Program. Personal communication between Noel Wong, URS and Suet Chau, EDAW.

Appendix E1.A
Summary of Environmental Analysis – Calaveras Reservoir Expansion

Any potential environmental impacts and proposed mitigations are those of CALFED and their consultants.

Table E1.A-1
Potential Environmental Impacts and Mitigation Opportunities
Calaveras Reservoir Expansion

Issue Area	***Potential Effects***	***Mitigation Opportunities***
Aquatic Resources / Fisheries	Reservoir expansion could affect upstream perennial and intermittent streams, including Arroyo Hondo and Calaveras Creek. Tributary streams contain native and non-native warmwater fishery resources (minnows, suckers, catfish, bass, and sunfish). Sensitive fishery resources include: anadromous steelhead trout, resident rainbow trout, and native non-game fish. Project may affect steelhead restoration within the Alameda Creek Watershed (EDAW, 2004).	Identify acreage of aquatic resources affected through habitat assessments, and restore resources in and around the watershed at a ration deemed appropriate by regulatory agencies (this would require consultation with regulatory agencies, acquisition of permits, and compliance with permit conditions). Continue trout planting.
Terrestrial Biological Resources(1)	Direct effects from inundation of terrestrial habitat including, but not limited to, non-native grassland; marsh; mixed evergreen forest / coast live oak woodland, Northern coastal scrub; pond; central coast arroyo willow and white alder riparian forest; blue oak woodland; sycamore alluvial woodland; valley oak woodland; and cultivated land) (EDAW, 2004). Highly sensitive communities include: Valley oak woodland, riparian forest, sycamore alluvial woodland, marsh, and area of potential serpentine associated plants.	Unavoidable Implement a mitigation strategy that provides for resource restoration or enhancement, in and around the watershed (EDAW, 2004). Conduct protocol-level surveys for species (EDAW, 2004). Consult with regulatory agencies; acquire relevant permits; implement permit conditions, which may include habitat restoration at a 3:1 ratio (actual ratio determined by negotiations with regulatory agencies) if permanent impact occurs.
	Additional disturbed acreage associated with construction of pipeline, pump station, regulating / hydroelectric station (EDAW, 2004).	
	Potential effects to species associated with the above identified habitat, including but not limited to seven species that have formal listings as endangered or threatened (in 1998): Bay checkerspot butterfly, Callipe silverspot butterfly, myrtle silverspot butterfly, California red-legged frog, Alameda whipsnake, Aleutian Canada goose, and bald eagle (EDAW, 2004).(2)	
Changes in Hydrology	Reservoir expansion would affect the morphology of upstream perennial and intermittent streams, including Arroyo Hondo and Calaveras Creek. (EDAW, 2004).	Further studies would be required to assess the severity of this impact to hydrologic cycle (EDAW, 2004).

Table E1.A-1
Potential Environmental Impacts and Mitigation Opportunities
Calaveras Reservoir Expansion

Issue Area	*Potential Effects*	*Mitigation Opportunities*
Cultural Resources	Potential adverse effects on known and unknown cultural resources from inundation (including submergence of cultural resources sensitivity zone) (EDAW, 2004).	Conduct field reconnaissance for potential cultural resources. Record historical resources requiring removal on relevant forms (EDAW, 2004). Avoidance through project redesign, construction monitoring, capping, screening, and fencing to create a zone of exclusion; if infeasible, second level of treatment would be implemented (i.e., documentation of each site, and retrieval of significant data) (EDAW, 2004).
	The dam, completed in 1925, is more than 50 years old, and may qualify for listing in the state or national inventory of historic resources. Removal of the dam may be considered a significant impact (EDAW, 2004).	
Submergence of infrastructure (existing buildings, roads, utility lines)	Inundation of existing structures (EDAW, 2004).	Rebuild structures, fire and access roads as needed (EDAW, 2004).
	Inundation of paved, unpaved, and primitive roads (E).	As needed, reroute road network to ensure sufficient maintenance roads and fire trails, etc. (EDAW, 2004)
	A 230-kilovolt transmission line runs through the watershed, west of Calaveras Reservoir. The corridor could be affected. Towers may or may not be submerged, depending on location. However, electric lines over water may affect maintenance of facility (EDAW, 2004).	Further evaluate affected transmission line, and relocate as needed (EDAW, 2004).
Recreation Resources	As described above, inundation of unpaved and primitive roads would occur. These roads may currently be used for permitted docent-led group hiking. Elimination of these trails would be a potential impact (EDAW, 2004).	Rebuild limited-access trails for hiking. To the extent feasible, provide trails outside of the Water Quality Vulnerability Zones (WQVZ, identified by SFPUC as areas where activities or disturbance would have the greatest potential to affect water quality of surface runoff and water stored in the reservoirs) for individual hiking access (EDAW, 2004).
Hazardous Materials and Contamination	Potential for hazardous material sites to be inundated and cause contamination problems. The USGS topographic map identifies a “Calaveras Test Site” south of the existing reservoir, which would be inundated if the proposed project is implemented. It is unknown what was tested at the site, but if hazardous material was stored previously, there is a potential for chemicals to affect the water body (EDAW, 2004).	Conduct a hazardous material database search of the area. Conduct a Phase I Assessment of the Calaveras Test site and other areas where the potential exist for current or historic storage and use of hazardous materials. Implement recommendations of these assessments, as necessary (EDAW, 2004).
Institutional Consideration	Mitigation measures implemented as a result of reservoir expansion may conflict with Alameda Watershed Management Plan policies. (EDAW, 2004)	Ensure that all mitigation measures comply with goals and policies of the Watershed Management Plan (EDAW, 2004).
Energy	Operation of the pump station would require consumption of nonrenewable energy (EDAW, 2004). Energy Consumption: TBD	Further evaluation would be required to determine the level of impact and mitigation opportunities.

Table E1.A-1
Potential Environmental Impacts and Mitigation Opportunities
Calaveras Reservoir Expansion

Issue Area	***Potential Effects***	***Mitigation Opportunities***
Future Water Supply Planning	Potential secondary effects of growth impacts related to provision of water for approved growth of jurisdictions receiving water from SFPUC (EDAW, 2004).	Measures of affected jurisdictions' general plan EIRs relevant to growth, and programs that address regional growth (traffic, air quality plans, etc.) would reduce potential secondary effects.
Socioeconomics	Water would be provided to all customers regardless of income levels (EDAW, 2004).	NA
Maximum Yield vs. Maximize Water Quality alternatives	Both alternatives would require expansion of the reservoir to 420,000 af, and thus would have similar effects. The difference between the alternatives is in the operation. The Maximize Water Quality alternative would reduce Delta pumping during the summer months of normal and wet years.	NA

(1) Qualitative data on potential impacts from reservoir expansion are based on overlaying an estimated 900-foot contour on an existing GIS model to identify the affected habitat and infrastructure. Contours on the GIS were generated from 10 m DEM at 20-foot intervals.

(2) The Alameda Watershed Management Plan EIR identifies animal species with high potential to occur within the Alameda Watershed (including the Calaveras Reservoir). They are as follows:

Invertebrates: Opler's longhorn moth, serpentine phalangid
Amphibians: California tiger salamander, California red-legged frog, foothill yellow-legged frog, western spadefoot toad, western pond turtle, southwestern pond turtle; coastal western whiptail
Birds: Cooper's hawk, sharp-shinned hawk, tricolored blackbird, golden eagle, great blue heron, short-eared owl, Aleutian Canada goose, ferruginous hawk, northern harrier, California horned lark, prairie falcon, bald eagle, and burrowing owl
Mammals: mountain lion

Source: SFPUC, 1998; ESA, 2000

E2. Los Vaqueros Reservoir Expansion Concept

Appendix E2
Los Vaqueros Reservoir Expansion Concept

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Appendix E2
Los Vaqueros Reservoir Expansion Concept

1.0 Concept Overview

1.1 Description

Los Vaqueros Expansion

Extended Dry Year Supply Reliability	42,000 AFY
Average Year Water Quality Supply	121,000 AFY

Cost (2002 dollars)

Capital Cost	$1,290 M
O&M Cost	$27.5 M/Yr
Unit Cost	TBD in future studies

Potential Owning Agency
TBD in future studies

Potential Bay Area and CALFED Agency Partners
CCWD, Zone 7, ACWD, SCVWD, DWR, USBR, SFPUC

The Los Vaqueros Reservoir Expansion would involve an increase in capacity from the existing size of 100,000 acre-feet (AF) up to 500,000 AF. Two reservoir capacities (300,000 AF and 500,000 AF) and two diversion capacities (1,000 cubic feet per second [cfs] and 1,750 cfs) have been evaluated by the CALFED Los Vaqueros Reservoir Expansion Studies Team

The CALFED Los Vaqueros Reservoir Expansion Studies also evaluated several operating modes for the reservoir, evaluating single purpose projects (e.g. drought supply to Bay Area agencies, or operations solely in support of environmental water) to determine the extent of benefits possible, and multi-purpose scenarios to balance objectives (a combination of the drought supply and environmental water). Water quality benefits are provided in all cases. For the current study, the multipurpose operating scenario is presented, with dry-year benefits, water quality benefits and water for Environmental Water Account (EWA) management. The multipurpose scenario with the 500,00 AF reservoir capacity and 1,750 cfs diversion capacity was selected for evaluation in the Bay Area Water Quality and Supply Reliability Program as an example of the types of benefits this concept can provide.

1.2 Potential Partners and Supply Amounts

Table E2-1 summarizes potential partners for the Los Vaqueros Reservoir Expansion concept.

Dry-Year Supply

CCWD, Zone 7, ACWD and SCVWD are potential recipients of water for dry-year supply reliability. There may be potential for the SFPUC to also benefit from Los Vaqueros Reservoir Expansion. This may be considered in future studies. The CALFED Los Vaqueros Reservoir Expansion Studies have estimated the following potential dry-year supply amounts:

- **CCWD** – 0-10,000 acre-feet/year (AFY) extended drought yield (depending on storage purchased).

- **SBA Contractors** – 32,000 AFY (average of WY1987-WY1992). Individual years range from 0 AFY (1987) to 55,000 AFY (WY1991).

- **SFPUC** – To be determined in future studies. SFPUC could potentially be a dry-year supply recipient, with deliveries via existing or new connections between the South Bay Aqueduct and San Antonio Reservoir, or via a new connection directly to the SFPUC Sunol Valley Water Treatment Plant.

Table E2-1
Potential Partner and Supply Amounts

Agency	*Type of Benefit*	*Potential Amount (AFY)*	*Notes/Issues*
CCWD	Dry-year supply	10,000 AFY	Estimated in Los Vaqueros Reservoir Expansion Studies (depends on storage purchased)
SBA Contractors (SCVWD, ACWD)	Dry-year supply	32,000 AFY (average of WY1987-WY1992)	Estimated in Los Vaqueros Reservoir Expansion Studies.
SFPUC(1)	Dry-year supply	To be determined in future studies.	Potential dry-year deliveries via the South Bay Aqueduct to San Antonio Reservoir, or to the Sunol Valley Water Treatment Plant.
SBA Contractors (Zone 7, SCVWD, ACWD)	Average year water quality potential improvement	121,000 AFY (average of WY1922 through WY1994)	Estimated in Los Vaqueros Reservoir Expansion Studies.

(1) For the purposes of this study, SFPUC includes retail customers and the 28 wholesale customers, BAWSCA member agencies.

Average Year Water Quality

The concept would reduce salt concentrations, including bromide, chloride and other ions, and other constituents such as total organic carbon. For the 500,000 AF reservoir with 1,750 cfs diversion, the Los Vaqueros Reservoir Expansion Studies express salinity reductions in terms of average annual bromide ion reductions: SBA Contractors – from 188 micrograms/liter (μg/L) (baseline) to 128 μg/L; CCWD – from 167 μg/L (baseline) to 142 μg/L[1]. Continuing studies will also evaluate other constituents including turbidity, algae, TOC and other relevant parameters.

Other Partners Considered but Not Included

Additional Bay Area water agencies other than CCWD, ACWD, Zone 7, SCVWD and SFPUC are participating in the review of the Los Vaqueros Reservoir Expansion concept, but have not expressed an interest in potential partnership. Potential partners outside the Bay Area have not been considered.

1.3 Operating Description

Under the environmental water operations, the expanded Los Vaqueros Reservoir would store high quality water during periods of high flow when diversions would have lower impacts on aquatic resources. The project would deliver up to 210,000 AFY of Delta water to the South Bay Aqueduct via a new pipeline from the reservoir to the South Bay Aqueduct's Dyer Backsurge Pool to allow reduced pumping at the Harvey O. Banks (Banks) Pumping Plant and the Tracy Pumping Plant. This reduction in pumping, especially during dry years and during the summer months will help meet EWA Program objectives to protect aquatic resources and improve habitat conditions. Water would be stored in the reservoir when Delta water quality is high, so that delivered water quality to the South Bay Aqueduct would be improved.

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[1] Average water quality taken as long term average from 1922 through 1994.

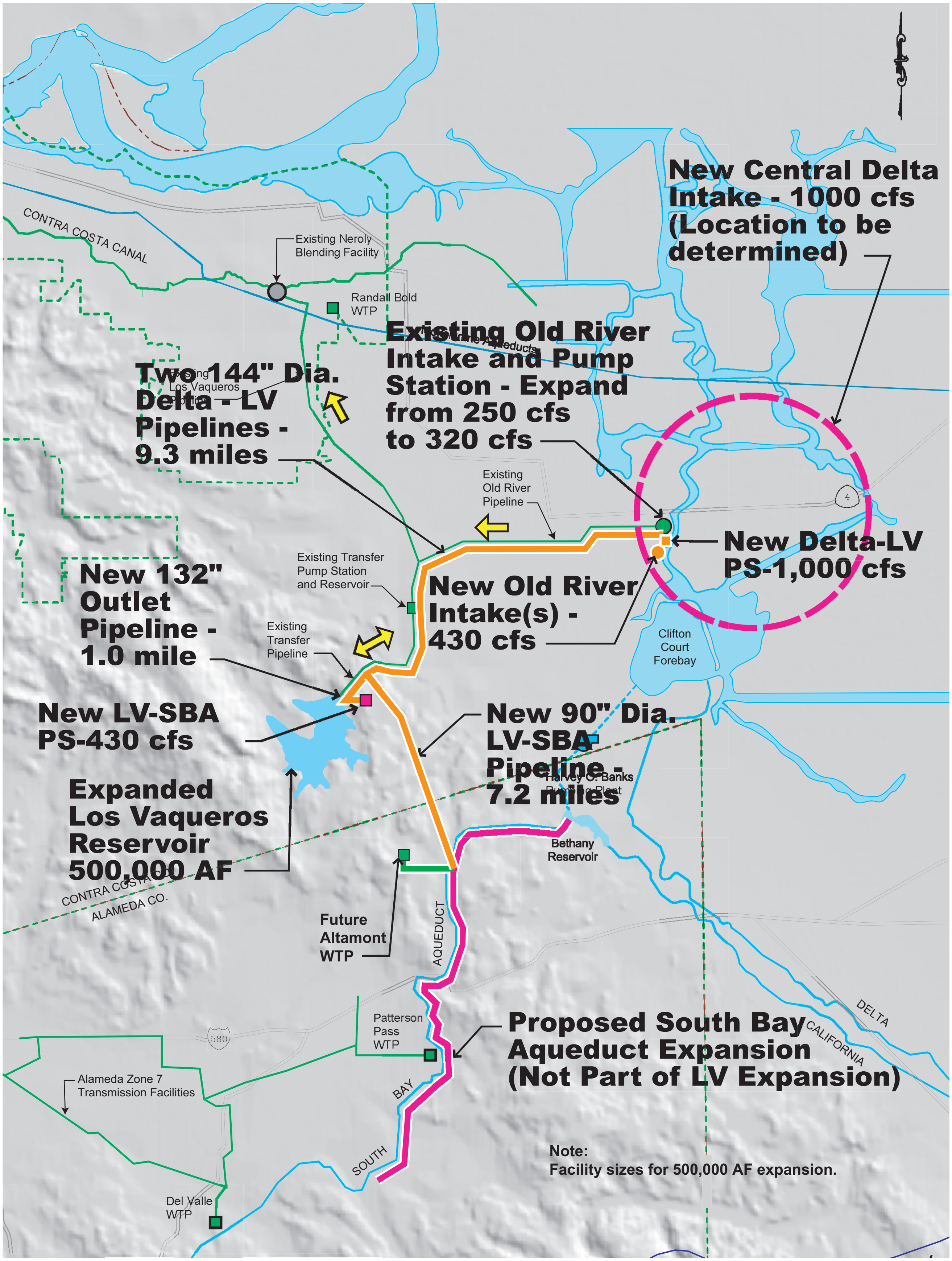
Water pumped to the reservoir would be dedicated to the EWA. The resources agencies managing the EWA would curtail pumping at Banks or Tracy Pumping Plants during critical times of the year to protect aquatic resources and improve habitat conditions. During pumping curtailment, San Luis Reservoir would be used to supply South of Delta SWP or CVP water contractors who would otherwise receive water from Banks or Tracy Pumping Plants, and SBA contractors would receive water from Los Vaqueros Reservoir. To refill the water "borrowed" from San Luis Reservoir, capacity would be made available at the Banks Pumping Plant by delivering water to the SBA from Los Vaqueros Reservoir throughout the year, reducing the pumping requirements from Banks Pumping Plant to the SBA.

Water would be pumped from the Delta to the expanded Los Vaqueros Reservoir during winter and spring months when Delta flows are higher, Delta water quality is high, surplus water is available and fishery impacts are lower. Deliveries to the SBA would be made from Los Vaqueros Reservoir, rather than the South Bay Pumping Plant as described above. These deliveries would occur at times of the year when water quality in the reservoir is equal to or better than water quality in the Delta. Therefore, the project would provide water quality benefits of reduced chlorides, total dissolved solids, total organic carbon and bromides in many years.

Under the multi-purpose operating scenario evaluated in the BAWQ&SRP, the expansion would be operated to optimize both water quality and drought reliability benefits for Bay Area water agencies. In drier years, hydrological constraints may prevent SWP and CVP contractors from receiving the full amount of their contract supplies. An expanded Los Vaqueros Reservoir could be used to store water in wet years that could be used to improve supply reliability for these customers in dry years.

2.0 Potential Project Facilities

Figure E2-1 and Table E2-2 summarize the potential facilities needed to implement this concept.


New Central Delta Intake - 1000 cfs (Location to be determined)
CONTRA COSTA CANAL
Existing Neroly Blending Facility
Randall Bold WTP
Existing Old River Intake and Pump Station - Expand from 250 cfs to 320 cfs
Two 144" Dia. Delta - LV Pipelines - 9.3 miles
Existing Los Vaqueros Pipeline
Existing Old River Pipeline
4
New Delta-LV PS-1,000 cfs
Existing Transfer Pump Station and Reservoir
New 132" Outlet Pipeline - 1.0 mile
Existing Transfer Pipeline
New Old River Intake(s) - 430 cfs
Clifton Court Forebay
New LV-SBA PS-430 cfs
New 90" Dia. LV-SBA Pipeline - 7.2 miles
Harvey O. Banks Pumping Plant
Expanded Los Vaqueros Reservoir 500,000 AF
Bethany Reservoir
CONTRA COSTA CO.
ALAMEDA CO.
Future Altamont WTP
AQUEDUCT
Patterson Pass WTP
580
Proposed South Bay Aqueduct Expansion (Not Part of LV Expansion)
DELTA
CALIFORNIA
BAY
SOUTH
Alameda Zone 7 Transmission Facilities
Del Valle WTP
Note:
Facility sizes for 500,000 AF expansion.

Legend

▬ Los Vaqueros Expansion Facilities

Figure E2-1

Los Vaqueros Reservoir Expansion Concept Facilities

Table E2-2
Potential Project Facilities for Los Vaqueros Reservoir Expansion Concept[1]

Facility
Dam • New earthfill embankment dam and spillway o 360-foot high, 2,300 foot long crest
Intakes • Expand CCWD's existing Old River intake from 250 cfs to 320 cfs • Provide new 430 cfs screened intake at Old River • Provide new 1000 cfs screened intake in the Central Delta (Victoria Canal or equivalent)
Pipelines • 3.0 miles from the Central Delta intake to the Delta Pump Station (PS) o Two 114-inch diameter pipelines • 9.3 miles of 144-inch (or two 132-inch) pipeline from the Delta PS to Los Vaqueros Reservoir o Two 132-inch diameter pipelines • 7.2 mile 90-inch diameter pipeline to South Bay Aqueduct, Dyer back surge pool • 1 mile 132-inch diameter outlet pipeline
Pump Stations • Delta PS at Old River o 182,000 HP • 36,000 HP Los Vaqueros to South Bay Aqueduct PS
Recreation Facilities • Hiking trails • Picnic areas • Interpretive center • Marina • Other
Other Facilities • Flow control station and balancing reservoir

1. Assumes 500,000 AF reservoir, 1,750 cfs diversion capacity, Multipurpose operation.

Basis for Facility Sizing

In the CALFED Los Vaqueros Reservoir Expansion Studies (CALFED, 2004), conceptual facilities layouts, pump station and pipeline sizing and pipeline alignment and costs were prepared for an expanded Los Vaqueros Reservoir.

3.0 Engineering Analysis

This section provides an overview of the physical and cost aspects of the project that will be assessed in the detailed concept and portfolio evaluation (the "scorecard"). Where information is currently available, it has been included in the following sections. However, much of the scorecard data will be developed after agreement on the concepts.

3.1 Project Costs

Table E2-3 summarizes project capital, operating and annualized costs.

Table E2-3 [1]
Estimated Project Costs (million $)

Capital Costs	
Intake Facilities	53.4
Delta Conveyance Pipeline	55.2
Pipelines	182.5
Pump Stations	247.6
Balancing Reservoir/Flow Control Sta.	4.0
Dam	284.5
Power Supply	16.1
Recreation Facilities	20.0
Mobilization	17.3
Construction Cost Subtotal	881.0
Other Project Costs	409.0
Total Capital Cost (2002)	1290.0
Total Capital Cost (2008)	1514
Operating Costs	
Intake Facilities	2.67
Pipelines	2.38
Pump Stations	20.81
Balancing Reservoir/Flow Control Sta.	0.10
Dam	0.43
Power Supply	0.08
Recreation Facilities	1.00
Total Operating Cost	27.46
Annual Costs	
Annualized Capital Costs	TBD[2]
Operating Costs	27.46[2]
Total Annual Cost	TBD[2]

1. Assumes 500,000 AF reservoir, 1,750 cfs diversion capacity, Multipurpose operation.
2. To be determined by the CALFED Los Vaqueros Reservoir Expansion Studies.

Basis for Cost Estimates

Cost estimates are from CALFED Los Vaqueros Reservoir Expansion Studies (CALFED, 2004). Mitigation costs, annual costs, and potential cost sharing options are being evaluated in the CALFED Finance Options Report.

3.2 System Vulnerability

CCWD and the South Bay Aqueduct contractors (Zone 7, ACWD, SCVWD) are susceptible to water quality problems in the Delta, including potential Delta levee failures during a major seismic event. Expansion of the Los Vaqueros Reservoir would reduce the vulnerability of these agencies to these potential water quality problems. The expansion would also provide additional redundancy in the case of operations problems with the Harvey O. Banks Pumping Plant and the South Bay Pumping Plant. CCWD would also benefit by having additional pumping plant redundancy and storage due to operational or water quality problems.

3.3 Supply Reliability

For the multi-purpose scenario, CCWD could have an extended drought reliability benefit of up to 10,000 AFY (depending upon storage purchased), and SBA contractors SCVWD and ACWD could have a total supply reliability benefit of up to 60,000 AFY. The distribution of reliability benefits within the 60,000 AFY maximum will be dependent on the interagency agreements.

3.4 Water Quality

CCWD water quality would be improved with the Los Vaqueros Reservoir Expansion in two ways. The project would divert water from the Central Delta, where water quality is better than conditions in Old River, generally from July through at least November. In addition, the larger intake capacity would allow CCWD to pump more CVP contract water to the reservoir during the months of July and August, when Delta water quality is good. With the current diversion capacity, CCWD diverts some CVP contract water during fall and early winter, and blends this with water released from the Los Vaqueros Reservoir.

Water quality to SBA contractors could potentially be improved by reductions in concentration levels and reductions in variations of constituents such as salinity (chloride and bromide ion and total dissolved solids concentrations) and organic carbon. However, further studies will be completed as part of the CALFED Los Vaqueros Reservoir Expansion Studies to better quantify these benefits, particularly at downstream locations in the South Bay Aqueduct (downstream of Del Valle Reservoir). More information is provided in the Reservoir Water Quality Technical Memorandum (CALFED 2004).

3.5 Schedule

Completion of the environmental documentation is anticipated by mid-2007. The 500,000 AF project has an estimated 57 month construction period. (CALFED, 2004). This schedule is dependent on certification of the CEQA and NEPA documents and agreement by both the potential participating agencies, as well as finalization of funding arrangements.

4.0 Environmental Analysis

This section summarizes the environmental analysis for this concept under the general environmental categories that will be presented in the detailed concept and portfolio evaluation (the "scorecard"). A more comprehensive environmental summary is included as Appendix A. Information in this section was primarily developed from a review of documents from the Los Vaqueros Reservoir Expansion Studies, Planning Report (CALFED, 2004), as well as knowledge of similar projects (EDAW, 2004).

4.1 Potential Environmental Benefits

Environmental benefits are defined as an overall improvement to some aspect of environmental quality, to the land, air, or water. The potential benefits associated with the proposed concept include the following:

- Installation of State-of-the-art fish screens for diversions to the SBA;
- Flexibility to shift the timing and location of water diversions to protect fish;
- System flexibility to store and move water (including for environmental water storage); also, provision of additional storage (for natural disasters, toxic spills, or levee failures in the Delta);
- Protection of terrestrial species and habitat enhancement;
- Flood protection for downstream areas along Kellogg Creek; and
- Provision of additional recreational opportunities.

4.2 Potential Environmental Impacts

Environmental impacts are defined as degradation in the quality of the environment that will likely require mitigation. Table E2-4 summarizes potential environmental impacts of the project, identifying the issue area, impacts and mitigation opportunities for aquatic resources, terrestrial resources, wetlands and energy consumption. Other potential environmental impacts, including but not limited to land use and construction-related effects, are discussed in Appendix A. Impacts and mitigation opportunities were identified in the Los Vaqueros Reservoir Expansion Planning Report.

5.0 Regulatory and Institutional Analysis

This section summarizes the regulatory and institutional evaluation for the general categories that will be assessed in the detailed concept and portfolio evaluation (the "scorecard").

Table E2-4
Summary of Potential Environmental Impacts
Los Vaqueros Reservoir Expansion

Issue Area	***Potential Impacts***	***Mitigation Opportunities***
Delta Resources (Aquatic)	The Expansion Studies, Planning Report, examined potential impacts on Delta fishery and aquatic resources. Fishery data was compiled from studies and monitoring reports, and used to document species composition, geographic and seasonal distribution, and seasonal abundance. Information on the seasonal distribution of early lifestages of fish species was used to assess vulnerability to direct entrainment loss and to identify potential modifications to seasonal diversion operations that would minimize or avoid entrainment mortality (CALFED, 2004). Net benefit by reducing direct fish losses from water diversions (incremental increase in loss of juvenile fish at the new Delta intakes offset by a substantial reduction in direct fish loss at the SWP [or CVP] diversion facility); similar net benefits to Delta aquatic habitat. (CALFED, 2004)	NA
Biological Resources (Terrestrial)	Inundation impacts from reservoir expansion are unavoidable and represent the majority of the project's direct impact on terrestrial resources. Impacts from other facilities (e.g., pipelines and pump stations) may be further reduced through more detailed siting efforts to be completed in the next study phase. Total direct effects to terrestrial habitat (temporary and permanent) could be up to 2,595 acres (2,081 acres of grassland; 309 acres of oak woodland; 11 acres of chaparral / upland scrub; 0.01 acre of riparian; 3.6 acres of urban-ruderal; and 189 acres of agriculture). 1,960 acres would result from inundation alone. Each habitat type is associated with special-status species. A small portion of the kit fox easements would be affected on the northwest side. However, grassland on eastern side of the reservoir would continue to provide potential kit fox dispersal habitat (CALFED, 2004).	A comprehensive mitigation strategy would be implemented that is cost-effective, provides for resource enhancement in accordance with CALFED Program guidance, and is coordinated for regional conservation. The mitigation strategy includes a combination of increased and expanded efforts on the existing watershed lands, restoration and enhancement efforts on land owned by potential partner agencies or regional open space managers, and acquisition of additional land for protection, restoration, and / or enhancement. Mitigation acreage requirements would range from 1,953 to 8,576 acres (CALFED, 2004).
	Effects on biological resources from siting, construction, and operation of new facilities, including Delta intakes, pump station, and pipelines (CALFED, 2004).	Conduct siting studies to avoid or minimize impacts to riparian areas, oak woodlands, and chaparral habitat (CALFED, 2004).
	Indirect effects on habitat and species associated with recreational opportunities, including installing trail on east side of the reservoir, which is currently closed to the public (CALFED, 2004).	As is currently implemented by CCWD within the Watershed, seasonal restrictions on recreation use areas would likely be included as part of the future mitigation strategy to minimize indirect effects on sensitive habitats or species. See above description of the overall mitigation strategy for the proposed project (CALFED, 2004).
Wetlands	Total direct effects 1.3 acres of wetland	Conduct siting studies to avoid or minimize impacts to wetlands. Total mitigation acreage for effects to marsh / wetlands marsh range from 1.6 to 4.5 acres (part of the total identified for the Terrestrial Biological Resources, above) (CALFED, 2004).
Energy	Operation of the pump stations would require consumption of nonrenewable energy ((CALFED, 2004; CDM, 2004). 500,000 af (1,750 cfs intake) – 183 million kwh	Further studies needed to assess impacts and the potential need for installation of hydroelectric plants (EDAW, 2004).

5.1 Permitting

Surface water reservoir projects require a number permits from agencies with jurisdiction over the sensitive biological resources, including the U.S. Army Corps of Engineers, California Department of Fish and Game, Regional Water Quality Control Board, and U.S. Fish and Wildlife Service. In addition, the California Division of Safety of Dams reviews plans and specifications for the construction of new dams or for the enlargement, alteration, repair, or removal of existing dams. Changes in existing water right permits would also be required, including changes in rates and points of diversion and place of use. Some or all of the water diverted to the reservoir may fall under existing CVP, SWP and CCWD permits; additional permits may be required for the diversion of surplus flows for the EWA, if not already included in SWP and CVP permits.

The permits and consultation required for the expansion of the facility would likely be informed by and be consistent with those obtained as part of the original reservoir construction. Expansion of the proposed reservoir would affect mitigation lands that were established previously during the original reservoir development for protection of biological resources. The disturbance and inundation of these lands may add to the complexity of the permitting process.

The combined CEQA/NEPA compliance and permitting process may take a couple of years, mostly for negotiations with regulatory agencies, as most of the background surveys, studies, and documentation have been completed. To minimize the implementation schedule, the CEQA/NEPA environmental review will be conducted in parallel with the permitting process; as studies of the reservoir expansion have been ongoing, it is likely that detailed information is available for submittal to regulatory agencies.

See Appendix A for a summary of anticipated permits.

5.2 Institutional Issues

The potential participating agencies include CCWD, ACWD, Zone 7, SCVWD, DWR and/or USBR. The Los Vaqueros Reservoir Expansion Studies, Planning Report (2004) evaluates a variety of institutional arrangements consisting of federal, state, and local entities. The actual arrangement would be dependent upon the sources of project financing, which could come from a combination of any of these sources: federal (USBR), state (DWR), and local (Bay Area water agencies using the facilities).

Under all institutional structures, "CCWD would retain ownership and control of the watershed and operations of the project" (CALFED, 2004). An ownership agreement would be developed outlining this and CCWD's sole ownership and operation of the watershed and facilities that serve only CCWD. A governing entity would be formed to represent the project participants (beneficiaries of the project). The entity's functions would be multi-faceted and include: 1) collect payments from the participants for both capital repayments and Operations, Maintenance, and

Replacement (OM&R) costs; 2) enter into an operations agreement with CCWD (for OM&R); and 3) enter into water service and exchange agreements with the participants to provide an agreed-upon level of water service. Water delivery and exchange agreement(s) would define the terms and conditions for water storage and transfer, including the EWA (or its successor) (CALFED, 2004).

6.0 Outstanding Issues and Questions

- Assumptions for demand, supplies, and management options for ACWD will need to be updated for future expansion studies, as current ACWD deliveries are based on older ACWD projections. Although ACWD has developed new delivery projections, they have been developed for 1970 through 1993 hydrology only, and could not be extrapolated to the 1922 through 1969 period by the Los Vaqueros Expansion studies team.

- SFPUC benefits will need to be developed through additional modeling if SFPUC is interested in pursuing.

References

CALFED, 2004. Los Vaqueros Reservoir Expansion Studies, Planning Report, April 2004.

CALFED, 2004. Los Vaqueros Reservoir Expansion Studies, Reservoir Water Quality Technical Memorandum, January 2004.

CDM, 2004. Analysis by CDM for the Bay Area Regional Water Quality and Supply Reliability Program.

EDAW, 2004. Analysis by EDAW for the Bay Area Regional Water Quality and Supply Reliability Program.

Appendix E2.A

Summary of Environmental Analysis Los Vaqueros Expansion Concept

Table E2.A-1 Potential Environmental Impacts and Mitigation Opportunities Los Vaqueros Reservoir Expansion

Issue Area	***Potential Effects***	***Mitigation Opportunities***
Impact on CVP and SWP	The Los Vaqueros Reservoir Expansion Studies, Planning Report, evaluated the potential impact on the Central Valley Project (CVP) and the State Water Project (SWP). The Los Vaqueros Expansion Project has been designed to avoid adverse impact to SWP and CVP operations. Therefore, the project would not adversely affect CVP or SWP water deliveries, storage, ecosystem restoration obligations or other operations (CALFED, 2004). The Expansion Studies, Planning Report, examined pumping of Delta surplus flows associated with an expanded reservoir. If the X2 requirements[1] change from the base case, potential impacts would occur. However, the Expansion Studies, Planning Report, determined X2 requirements with a reservoir expansion would not change (CALFED, 2004)[1].	NA
Changes in Delta Hydrology	The Expansion Studies, Planning Report, examined two water-rights conditions for filling an expanded reservoir: (allow filling of the reservoir only when flows are in excess of the needs of the Delta or when CCWD's CVP contract supplies are available). These conditions ensure that there would be no impact on water users or the CVP. Changes in Delta flows would be minor (CALFED, 2004).	NA
Increase in local channel velocities could result in erosion and scouring near the levees	The Expansion Studies, Planning Report, examined potential impacts on local channel velocities associated with increased diversion, to determine the potential for greater erosion and scouring near the levees. Increases in maximum channel velocity exceeding 0.10 feet per second were considered significant. No significant impact would occur (CALFED, 2004).	NA
Changes in Delta water levels from intakes during certain periods can impede irrigation diversions from south	The Expansion Studies, Planning Report, examined potential impacts on Delta water levels. Analysis of DSM2 model was used to analyze for differences in south Delta water levels	Pumping could be reduced during those day(s) without impacting the water supply and quality benefits (CALFED, 2004).

Table E2.A-1 Potential Environmental Impacts and Mitigation Opportunities Los Vaqueros Reservoir Expansion

Issue Area	*Potential Effects*	*Mitigation Opportunities*
Delta Channels	relative to the base case. The results were then evaluated with respect to impacts near the expanded reservoir intakes and at key south Delta agricultural diversion stations. Model results from the Grant Line Canal station show maximum reductions of 0.1 feet in months that are or could be important to agriculture diverters (CALFED, 2004).	
Impact on Delta Water Quality	The Expansion Studies, Planning Report, examined potential impacts on Delta Water Quality. Increased pumping of surplus Delta flows to storage in winter months will have a minor impact on western Delta water quality that would be largely offset by reductions in the Banks Pumping Plant pumping. Reduction to Delta outflow, even excess flow, in one month may increase salinity in subsequent months because it takes time for seawater to intrude into (and be flushed from) the southern and eastern parts of the Delta. Studies show this is minor.	Only the increment of excess water above the first 2,000 cfs of surplus can be used by the project. In some cases, the buffer was increased to 15,000 cfs to ensure no significant salinity impacts were detected. (CALFED, 2004)
	Changes in salinity exceeding the greater of 5% or 5 mg/L chloride (10 mg/L TDS) would be considered potentially significant. However, salinity impacts to the south Delta were found to be not significant. In a few isolated cases in the fall, salinity may exceed 5% in the Western Delta. Overall, changes provide net benefits by allowing greater flexibility in managing Delta salinity and ecosystem conditions improvements.	Managing filling period to avoid salinity impacts without affecting the benefits of the project (CALFED, 2004)..

Table E2.A-1 Potential Environmental Impacts and Mitigation Opportunities Los Vaqueros Reservoir Expansion

Issue Area	*Potential Effects*	*Mitigation Opportunities*
Delta Fishery and Aquatic Resources	The Expansion Studies, Planning Report, examined potential impacts on Delta fishery and aquatic resources. Fishery data was compiled from studies and monitoring reports, and used to document species composition, geographic and seasonal distribution, and seasonal abundance. Information on the seasonal distribution of early lifestages of fish species was used to assess vulnerability to direct entrainment loss and to identify potential modifications to seasonal diversion operations that would minimize or avoid entrainment mortality (CALFED, 2004). No effect on fish or aquatic habitats of the Sacramento or San Joaquin River systems were identified (CALFED, 2004).	NA
	No effect on the vulnerability of fish to salvage losses at the export facilities. (Project would have a benefit by reducing water diversion through existing, less effective fish barrier facilities) (CALFED, 2004).	NA
	Net benefit for all scenarios by reducing direct fish losses from water diversions (incremental increase in direct loss of juvenile fish at the new Delta intakes offset by a substantial reduction in direct fish loss at the SWP [or CVP] diversion facility) (CALFED, 2004).	NA
	Incremental improvement in habitat quality and availability for fish and other aquatic organisms as timing of environmental water allocations would be flexible. Minor effects on the location of X2 could be possible (CALFED, 2004). New intakes would allow fish to pass by the diversion facility, avoiding impingement / direct loss, unlike the existing Clifton Court Forebay and the Tracy Pumping Plant (CALFED, 2004)..	NA

Table E2.A-1 Potential Environmental Impacts and Mitigation Opportunities Los Vaqueros Reservoir Expansion

Issue Area	***Potential Effects***	***Mitigation Opportunities***
Terrestrial Biological Resources	The Expansion Studies, Planning Report, examined potential impacts on terrestrial biological resources. Potential adverse effects are determined by the resources temporarily or permanently affected or removed. Total direct effects to terrestrial habitat (temporary and permanent) of up to 2,595 acres (2,081 acres of grassland; 309 acres of oak woodland; 11 acres of chaparral / upland scrub; 1.3 acres of wetland; 0.01 acre of riparian; 3.6 acres of urban-ruderal; and 189 acres of agriculture). 1,960 acres would result from inundation alone. Each habitat type is associated with special-status species[2]. A small portion of the kit fox easements would be affected on the northwest side. However, grassland on eastern side of the reservoir would continue to provide potential kit fox dispersal habitat (CALFED, 2004)..	Implement a mitigation strategy that is cost-effective, provides for resource enhancement in accordance with CALFED Program guidance, and is coordinated for regional conservation. Mitigation strategy includes a combination of increased and expanded efforts on the existing watershed lands, restoration and enhancement efforts on land owned by potential partner agencies or regional open space managers, and acquisition of additional land for protection, restoration, and / or enhancement. Mitigation acreage requirements would range from 1,953 to 8,576 acres (CALFED, 2004).
	Effects on biological resources from siting, construction, and operation of new facilities, including Delta intakes, pump station, and pipelines (CALFED, 2004).	Conduct siting studies to avoid or minimize impacts to wetlands, riparian areas, oak woodlands, and chaparral habitat (CALFED, 2004).
	Indirect effects on habitat and species associated with recreational opportunities, including installing trail on east side of the reservoir, which is currently closed to the public (CALFED, 2004).	As is currently implemented by CCWD within the Watershed, seasonal restrictions on recreation use areas would likely be included as part of the future mitigation strategy to minimize indirect effects on sensitive habitats or species. See above description of the overall mitigation strategy for the proposed project (CALFED, 2004).
Recreation Resources	The Expansion Studies, Planning Report, examined potential impacts on existing recreation facilities. Potential adverse effects are determined by the amount of facilities requiring removal and relocation. Expansion of the reservoir inundation footprint would require relocation of the Marina complex and shore-side facilities, hiking-only trails (10.6 miles) and portions of a multi-use trail (0.12 mile). Four fishing piers, and scattered staging / picnic areas consisting of 82 parking stalls, two toilets, two fishing piers, and 25 picnic tables would be relocated or replaced (CALFED, 2004).	Replace the Marina at one of three potential sites; Construct fishing piers in the vicinity of any of the potential Marina sites (redesigned to extend out to 100 feet); Restoration and augmentation of trails by constructing approximately 27.5 miles of trails (16.8 mile increase); provide trail links; consider new pipeline corridor easements for new hiking trails with the potential to link regional open space areas (CALFED, 2004). Installation of a second Interpretative Center at one of two sites (CALFED, 2004).
	Drainage of the reservoir would eliminate existing fish populations (CALFED, 2004).	Restock fish populations (CALFED, 2004).

Table E2.A-1 Potential Environmental Impacts and Mitigation Opportunities Los Vaqueros Reservoir Expansion

Issue Area	***Potential Effects***	***Mitigation Opportunities***
Cultural Resources	The Expansion Studies, Planning Report, examined potential impacts on existing cultural resources. Potential adverse effects on known and unknown cultural resources; total number of affected known sites would depend on siting of facilities. There are 74 known cultural resources and one sensitive relocation within the Los Vaqueros Reservoir Expansion Studies area (30 historic, 32 prehistoric, and 12 combined historic / prehistoric) (CALFED, 2004).	Avoidance through project redesign, construction monitoring, capping, screening, and fencing to create a zone of exclusion; if infeasible, second level of treatment would be implemented (i.e., documentation of each site and retrieval of significant data) (CALFED, 2004). Archaeological research; continued and enhanced public interpretation within the watershed; onsite Archaeology Center facility to serve as a museum, interpretative center, and curation facility (could be located in the new Interpretative Center) (CALFED, 2004).
Socioeconomic Resources	The Expansion Studies, Planning Report, examined potential socioeconomic effects. An IMPLAN input-output model was developed to estimate the direct and secondary impacts of an expansion on the county's economy. No adverse impact. Implementation of the project would generate 1,685 jobs annually during the construction period and decrease unemployment in the county by 0.36 percent, as well as offer opportunities for union apprenticeship and other worker development programs.	NA
Environmental Justice	The Expansion Studies. Planning Report, addressed the fair treatment of people of all races and incomes with respect to actions affecting the environment. The proposed project would improve quality of life by improving water quality (i.e., reducing health risks, reduce need for repair / replacement of household plumbing, improve taste), increase reliability of higher quality water supply, provide employment opportunities (particularly to low income families through training programs and increased incomes), and preserve lands (agriculture lands used for mitigation would be likely be designated open space / preservation) (CALFED, 2004).	NA
Future Water Supply Planning	The Expansion Studies. Planning Report, evaluated the expanded reservoirs role in providing for growth. The Los Vaqueros Reservoir expansion would provide drought reliability, and not provide yield for growth. Demands used in the development of project operations are consistent with the planning efforts of CCWD and potential Bay Area water agency partners (CALFED, 2004).	NA

Table E2.A-1 Potential Environmental Impacts and Mitigation Opportunities Los Vaqueros Reservoir Expansion

Issue Area	***Potential Effects***	***Mitigation Opportunities***
Energy	Operation of the pump stations would require consumption of nonrenewable energy (EDAW, 2004). 500,000 af (1,750 cfs intake) – 183 million kwh (CALFED, 2004; CDM, 2004)	Further studies needed to assess impacts and the potential need for installation of hydroelectric plants (EDAW, 2004).

Source: CALFED, Los Vaqueros Reservoir Expansion Studies, Planning Report, April 2004.

(1) X2 is an index used to assess the location of and thus the movement of salinity inland from the ocean to the Delta. It is defined as the distance in kilometers above the Golden Gate Bridge of two parts per thousand (ppt) salinity.

(2) Generally, the special status species located within the habitat that would be affected by the expansion includes: 1) California red-legged frog, 2) California tiger salamander, 3) western pond turtle, 4) bald eagle, 5) curved-foot hygrotis diving beetle, 6) Mason's lilaeopsis, 7) alkali milk-vetch, 8) heartscale, 9) brittlescale, 10) San Joaquin spearscale, 11) recurved larkspur, 12) Contra Costa goldfields, 13) vernal pool fairy shrimp, 14) mid-valley fairy shrimp, 15) longhorn fairy shrimp, 16) Golden eagle, 17) western burrowing owl, 18) tricolored blackbird, 19) Brewer's dwarf flax, 20) San Joaquin whipsnake, 21) Mt. Diablo fairy lantern, 22) diamond-petaled California poppy, 23) Diablo helianthella, 24) Mt. Diablo manzanita, and 25) San Joaquin kit fox.

Note: Potential impacts are examined for a 500 TAF reservoir with a 1,750 cfs intake, except for socioeconomic impacts, which consider the construction of a 1,000 cfs intake.

Table E2.A-2
Summary of Permitting and Consultation Requirements
Los Vaqueros Reservoir Expansion

Agency	*Type of Permit*
United States Army Corps of Engineers	Section 404/10, General or Individual (unless 404 R applies)
California Department of Fish and Game	Streambed Alteration Agreement California Endangered Species Act / NCCP
Regional Water Quality Control Board	Section 401 Water Quality Certification Section 402, NPDES General Construction Activity Storm Water Permit Waste Discharge Requirements, De-watering Activities
United States Fish and Wildlife Service	Section 7 Consultation
NOAA Fisheries	Consultation to USFWS
State Lands Commission	lease agreements
State Historic Preservation Office	Section 106 Compliance, National Historic Preservation Act
State Water Resources Control Board	Appropriate Water Right Permit – Amendment or Change Petition
Bay Area Air Quality Management District	Authority to Construct and Permit to Operate (for stationary sources that emit pollutants)
Division of Safety of Dams	Approval of Plans and Specifications to Construct or Enlarge a Dam
Various Agencies	Encroachment Permits

E3. Recycled Water Concepts

Appendix E3
Recycled Water Concepts

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Appendix E3
Recycled Water Concepts

1. Overview

Twenty-six recycled water concepts are currently being evaluated in the Bay Area Regional Water Quality and Water Supply Reliability Program. The following sections include descriptions of each concept under consideration, followed by a general discussion of the engineering, environmental, and institutional issues associated with recycled water concepts.

Table E3-1 provides a summary of the 26 recycled water concepts and Figure E3-1 shows the general location of recycled water concepts.

Table E3-1
Water Recycling Concepts

Project	***Dry-Year Supply (AFY)***	***Potential Beneficiaries***
ACWD-USD Recycled Water Feasibility Study Project, Phase I		
This project concept outlines Phase I of a proposal to construct a recycled water satellite treatment plant at the Irvington Wastewater Pump Station. Recycled water would be treated to Title 22 standards and distributed to users located in the southern and southwestern portions of the ACWD service area (e.g., the planned Newark Golf Course, the Pacific Commons Development and the planned Doublewood Golf Course).	1,650	ACWD, BAWSCA, SFPUC(1)
Burlingame Recycled Water Project		
The City of Burlingame is considering expanding recycled water production to 4 MGD (4,400 AFY) for unrestricted park landscaping and large landscaping uses involving customers located in the Bay-front area, including the San Francisco International Airport (SFO).	4,400	BAWSCA, Burlingame, Millbrae, SFO, SFPUC(1)
Central Contra Costa Sanitary District (CCCSD)- Industrial Recycled Water Project		
This project would provide advanced treatment of recycled water for industrial use at the Tesoro Power Plant, Foster Wheeler cogeneration facility, the Equilon Refinery (formerly Shell Martinez) and Rhoida (formerly Rhone-Poulenc).	17,920	Tesoro, other industrial users, CCWD
CCCSD - Irrigation Recycled Water Project		
This concept describes the potential treatment and conveyance of recycled water for irrigation in North Concord and Walnut Creek. This concept proposes 3,000 AFY (North Concord: 1,000 AFY; Walnut Creek: 2,000 AFY) of recycled water for irrigation (CCCSD Staff, June 2004).	3,000	EBMUD, CCWD
Coastside County Water District Recycled Water Project		
This proposed concept project would provide up 580 AFY of recycled water supply from the Sewer Authority Mid-Coastside Wastewater Treatment Facility (WWTP) for irrigation uses at two golf courses in Ocean Colony and the Skylawn Memorial Park Cemetery (Carollo, 2003).	580	Coastside CWD, BAWSCA, Ocean Colony, Skylawn Memorial Park Cemetery
Expanded Delta Diablo Sanitation District (DDSD) Recycled Water Project		
This concept would provide 1,600 AFY of recycled water supply for urban landscape projects and irrigation uses in DDSD's service area. These potential users include the Pittsburg City Hall and various golf courses (Baatrup, 2004).	1,600	CCWD industrial and irrigation users
Expanded DERWA Recycled Water Project		
DERWA is a Joint Powers Authority between Dublin San Ramon Services District (DSRSD) and East Bay Municipal Utilities District (EBMUD). This concept involves Phase II of the DSRSD portion of the San Ramon Valley Recycled Water Program (below), which will provide 1,430 AFY at a cost of $4.1 M. Phase II has not been financed and will depend on outside funding to proceed with planning and future construction.	1,430	EBMUD, DSRSD (Zone 7)

Table E3-1
Water Recycling Concepts

Project	*Dry-Year Supply (AFY)*	*Potential Beneficiaries*
Expanded San Ramon Valley Recycled Water Project		
Phases II and III of the EBMUD San Ramon Valley Recycled Water Project will yield 1,094 AFY of recycled water to portions of Blackhawk, Danville, Dublin and San Ramon. Recycled water would be produced at the DERWA facilities and distributed to residential and industrial customers. Planning has begun for Phase II and Phase III, which could begin as soon as 2005 and 2008, respectively. Neither Phase II nor Phase III has been financed and the ambitious schedule would depend largely on obtaining funding relatively soon.	1,904	EBMUD, City of Blackhawk, City of Danville, City of Dublin, City of San Ramon
Expanded East Bayshore Recycled Water Project		
The second and third phases of the East Bayshore Project will provide 2,016 AFY recycled water to portions of Alameda, Albany, Berkeley, Emeryville and Oakland. Construction for Phase IB is expected to begin in 2009 and for Phase 2 in 2013. Neither Phase IB nor Phase 2 has been financed and therefore both are contingent upon securing additional funds.	2,016	EBMUD, City of Alameda, City of Albany, City of Berkeley, City of Emeryville, City of Oakland
Expanded South Bay Water Recycling		
This concept proposal involves implementing the remaining elements of the South Bay Water Recycling (SBWR) project that have not already been financed. Expansion of pipelines into Santa Clara and Milpitas, construction of the Silver Creek Pipeline into Coyote Valley (South San Jose) and additional reservoirs are all proposed for Phase II (SCVWD, 2004). The project overall cost of $208-$241 million does not include advanced treatment or expansion of the recycled water production facilities.	16,800	Santa Clara, San Jose, and Milpitas (SCVWD, SFPUC(1), BAWSCA)
Franklin Canyon Recycled Water Project		
Wastewater from the Pinole and Hercules treatment plants would be conveyed to a recycled water facility in the Hercules area and treated to produce 0.3 MGD (336 AFY). Recycled water would then be distributed to various users, potentially including the Tosco Carbon Plant, Franklin Canyon Golf Course, and a variety of other irrigation and industrial users in the area (EBMUD, 2004).	336	EBMUD
Lamorinda Recycled Water Project – Phase I		
This project would supply approximately 1 MGD (1,120 AFY) of recycled water to customers in areas of Walnut Creek, Pleasant Hill, Lafayette, Moraga and Orinda for landscape irrigation. The recycled water would be produced at CCCSD's Recycled Water Plant and distributed to golf courses, schools, parks, cemeteries, etc.	1,120	CCCSD, EBMUD
Livermore Agricultural Recycled Water Project		
This concept would expand the current use of the Livermore Wastewater Reclamation Plant (LWRP) by 2,660 AFY to supply vineyards in the Livermore area (Brown and Caldwell, 2003).	2,660	Livermore (Zone 7)
Livermore Municipal Recycled Water Project		
This project would increase the demand for recycled water from the LWRP to 5 MGD (representing an increase of up to 2,800 AFY) by expanding the existing irrigation customer base to developments located north of I-580 (Greenwood, 2004).	2,240 – 2,800	Livermore (Zone 7)

Table E3-1
Water Recycling Concepts

Project	***Dry-Year Supply (AFY)***	***Potential Beneficiaries***
Millbrae Recycled Water Project		
The City of Millbrae has considered expanding their recycled water production by upgrading the existing Millbrae WWTP to produce 1.0 MGD of tertiary treated recycled water for unrestricted use (RMC, 2003). Recycled water would be conveyed from the Millbrae WWTP to customers located in Millbrae and adjacent areas of San Bruno, Burlingame and SFO.	1,120	Millbrae, San Bruno, and Burlingame (BAWSCA, SFPUC(1)); SFO (SFPUC(1))
NCCWD/Pacifica Recycled Water Project		
The North Coast County Water District (NCCWD), in a partnership with SFPUC, has developed a program to make recycled water available to the San Francisco-owned golf course in Pacifica, the Sharp Park Golf Course, and also extending recycled water to the Jefferson Unified School District, the City of Pacifica, and CalTrans for Highway 1 irrigational uses, and other potential irrigation customers (RMC, 2003, Kennedy/Jenks, 2001, BAWSCA, 2004).	225	NCCWD, BAWSCA, SFPUC(1)
North Richmond Expansion Recycled Water Project		
The West County Wastewater District currently provides secondary treated wastewater effluent to the North Richmond Water Reclamation Plant, owned by EBMUD, for tertiary treatment. This project involves the production of 4 MGD of recycled water. Existing treatment facilities would be used to serve 1 MGD to a fourth cooling tower at the Chevron Texaco refinery and irrigation customers. The project would also involve the construction of additional advanced treatment facilities to serve 3 MGD to ChevronTexaco for boiler feed water.	4,480	EBMUD
Palo Alto Recycled Water Projects		
The Palo Alto recycled water concept would entail the production of 1,830-4,677 AFY of recycled water at the Palo Alto Regional Water Quality Control Plant (RWQCP) for distribution within the local service area for irrigation and commercial/industrial uses.	1,830 – 4,677	BAWSCA, Palo Alto, East Palo Alto, Stanford University, Mountain View, Los Altos/Los Altos Hills, SFPUC(1)
Palo Alto RWQCP – Mountain View Recycled Water Project		
The Palo Alto RWQCP– Mountain View recycled water project would entail the production of recycled water at the Palo Alto RWQCP for distribution to portions of Palo Alto, the Mountain View Shoreline Area and Moffett Field for irrigation and industrial usage.	1,480 – 1,860	BAWSCA, Palo Alto, Mountain View, Moffett Field, SFPUC(1)
Redwood City/SBSA Recycled Water Project		
This concept would involve the production up to 3,238 AFY of recycled water at the South Bayside System Authority (SBSA) WWTP, for distribution to customers in Redwood Shores, the greater Bay-front area, and Central Redwood City areas of Redwood City for irrigation, industrial and other non-potable uses. There is also potential to expand the project to serve adjacent communities (Kennedy/Jenks, 2002).	1,960	BAWSCA, Redwood City, San Carlos, Belmont, SFPUC(1)

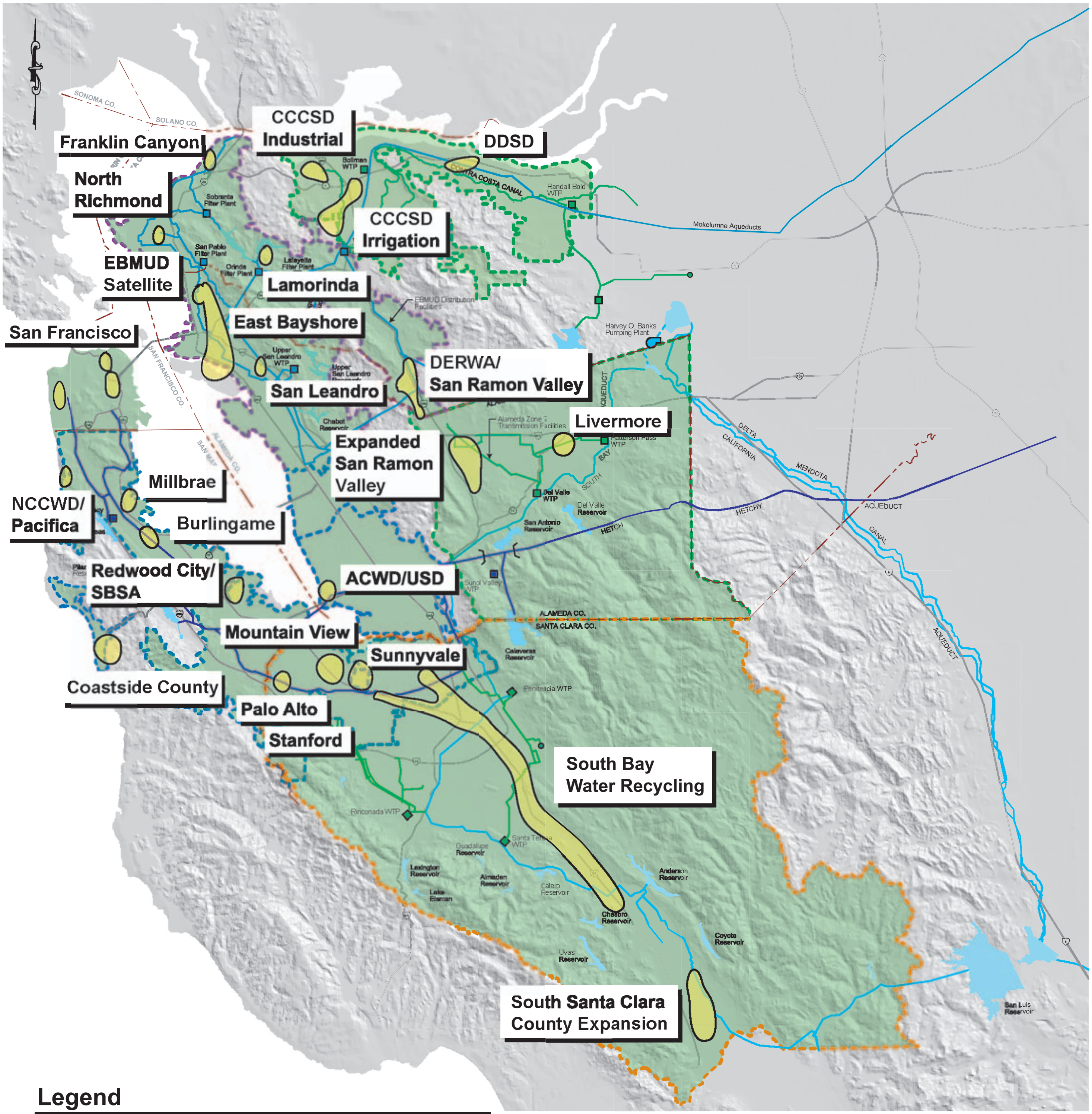
Table E3-1
Water Recycling Concepts

Project	*Dry-Year Supply (AFY)*	*Potential Beneficiaries*
San Francisco Recycled Water Project		
The City and County of San Francisco is currently preparing a Recycled Water Master Plan Update to provide guidance for the implementation of recycled water projects in the City. The Recycled Water Master Plan Update builds upon recycled water plans and studies conducted in the City in the 1990s. It will consider new technologies as well as potential new markets for recycled water. The draft Plan is scheduled to be completed in the summer of 2005. The final Plan including the CEQA review process will be completed in 2006, so that construction of recycled water projects can begin.	Up to 19,000	SFPUC(1)
San Leandro Recycled Water Project		
The San Leandro Reclamation (SLR) Facility would expand production of recycled water by upgrading the SLR Facility to provide existing customers with tertiary-treated water and an additional 0.5 MGD (560 AFY) of tertiary-treated water to potential irrigation, industrial and commercial customers (EBMUD, 2004).	1,060	San Leandro (EBMUD)
Satellite EBMUD Recycled Water Project		
EBMUD has initiated a study to determine the feasibility of constructing satellite WWTPs within the District water service area. This project concept involves the design and construction of a pilot demonstration plant for feasible customers. The University of California, Berkeley could potentially be a partner in the project, and the pilot demonstration plant could possibly be located at the university to serve some of its irrigation demand. Additional satellite WWTP projects could potentially follow a successful pilot demonstration project.	20	EBMUD
South Santa Clara Water Recycling		
The South County Water Recycled Water project concept details the improvements planned for recycled water program of SCVWD, South County Regional Wastewater Authority, and the City of Gilroy. These improvements include construction of two 3-MGD pump stations, construction of two 3-MGD storage reservoirs and the installation of 27,000 feet of distribution pipeline.	1,800	SCRWA, SCVWD, City of Gilroy
Stanford University Recycled Water Project		
Stanford University is considering three recycled water projects: capturing on-campus wastewater sources that are initially discharged to the campus sewer system before being discharged to the Palo Alto RWQCP (up to 644 AFY); capturing on-campus and additional nearby off-campus wastewater sources from Stanford University facilities that currently discharge to the Palo Alto RWQCP (up to 1,094 AFY); and sharing part of the capital costs for Palo Alto's Regional Recycling Project and purchasing the RWQCP's recycled water, see discussion of the Palo Alto Recycled Water Project (up to 1,800 AFY).	72 – 1,094	Palo Alto, SFPUC(1), SCVWD, BAWSCA

Table E3-1
Water Recycling Concepts

Project	***Dry-Year Supply (AFY)***	***Potential Beneficiaries***
Sunnyvale Recycled Water Project		
This project involves the expansion of recycled water use within the service area of Sunnyvale's Water Pollution Control Plant for irrigation and other purposes. This project would provide recycled water to potential users that are already connected to the recycled water system. It may be possible to extend the distribution to new users if additional funding is secured.	1,470	BAWSCA, Sunnyvale, SFPUC(1)

(1) For the purposes of this study, SFPUC includes retail customers and the 28 wholesale customers, BAWSCA member agencies.



Legend

⬭ Recycling Area

🟩 Potential Dry Year Yield Beneficiaries

Figure E3-1

Locations of Potential Water Recycling Concepts

CDM

2. ACWD-USD Recycled Water Feasibility Study Project, Phase I (up to 1,650 AFY)

2.0 Concept Overview

2.0.1 Description

Alameda County Water District (ACWD), in partnership with the Union Sanitary District (USD), is actively investigating opportunities for recycled water production/use in its service area. The two districts have conducted several studies to determine the feasibility of recycled water production and distribution. This project concept details the results of the most recent recycled water study completed in 2003 and outlines Phase I of a proposal to construct a recycled water satellite treatment plant at the Irvington Wastewater Pump Station. Recycled water would be treated to Title 22 standards and distributed to users located in the southern and southwestern portions of the ACWD service area (e.g., the planned Newark Golf Course, the Pacific Commons Development and the planned Doublewood Golf Course).

ACWD-USD Recycled Water Project

Yield

Supply Yield	up to 1,650 AFY
Quality Yield	0 AFY

Cost

Capital Cost	$33 M
O&M Cost	$400 K
Unit Cost	$1,700/AFY

Partners

ACWD, USD, BAWSCA, SFPUC

This project concept would provide many benefits to ACWD, USD, and the local environment. These benefits include a reduced dependence on imported supplies, a decrease in the amount of wastewater discharged into the Bay and a potential enhancement of habitat and species health in tidal salt marshes where wastewater flows would be reduced. This project concept would improve dry-year supply reliability by providing a new, firm source of supply.

In addition, this project concept would provide dry-year water quality improvements of ACWD's potable supply. By providing an alternative source for a portion of ACWD large landscape and industrial demands, this project would allow ACWD to increase the proportion of high quality SFPUC water used for blending with local ground water supplies, thereby improving potable water quality without increasing demand for Sierra Supply.

2.0.2 Potential Partners and Supply Amounts

At this time potential partners for the concept include USD. Other possible partners may include BAWSCA, of which ACWD is a member, and SFPUC.

Dry-Year Supply

The total available dry-year supply for the concept is 1,650 AFY or 1.5 MGD. Table E3-2 provides a summary of potential partners and long term supply amounts.

Table E3-2
Potential Partner and Supply Amounts

Partner	***Type of Benefit***	***Potential Amount (AFY)***	***Notes/Issues***
ACWD	Dry-year supply reliability	1,650	USD treats wastewater in ACWD service area.
BAWSCA	Dry-year supply reliability	TBD	
SFPUC	Dry-year supply reliability	TBD	Project would potentially conserve SFPUC supplies and potentially increase dry-year reliability.
Total		1,650 AFY	

Average Year Water Quality

No information is available for this study.

Other Potential Partners Considered but Not Included

No other beneficiaries have been considered for this project.

2.0.3 Operating Description

The project concept describes Phase I of a recycled water project which involves diverting a portion of the wastewater flow received at Irvington Pump Station, treating it to California Title 22 Standards and distributing it to recycled water customers in the area.

Two distribution mains are included in Phase I. One pipeline is routed to the northwest along local roads and is sized to serve future demands identified in the 1996 recycled water master plan update. A second distribution main is generally routed to the east along local roads, crossing under I-880, a Southern Pacific railroad track and an interchange at I-680. It is then routed north along Green Valley Road to a 2 MGD storage tank located near Doublewood Golf Course. The Doublewood Golf Course and smaller demands at the Cedar Lawn Memorial Park and Sunny Hill Golf Center are the only demands served by the second main (CH2MHILL, 2003).

2.1 Project Facilities

Table E3-3 summarizes the proposed facilities for this concept.

Table E3-3
Project Facilities for ACWD-USD Recycled Water Concept

Facility	***Notes***
Irvington Pump Station Satellite Plant 1.5 MGD • Membrane Bioreactor: (4) 375,000 gal, basins • Micro or Ultra Filtration • UV Disinfection • Discharge	The pump station would be modified to treat wastewater to tertiary standards as outlined in Title 22 Recycled Water requirements.
Storage • 2 MG Storage Tank	An elevated storage tank in Fremont would provide equalization and serve peak demands that exceed capacity of the facility.
Pipelines • Distribution pumps: 2 on duty, 1 standby • Distribution piping (18-24")	

Basis for Facility Sizing

Preliminary sizing of the WWTP tertiary treatment process capacity 1.5 mgd is based on the CH2MHILL 2003 RW report and confirmed by personal communications with Eric Cartwright, ACWD, May 11, 2004.

2.2 Project Costs

Table E3-4 summarizes project capital, operating and annualized costs.

Table E3-4
Estimated Project Costs

Capital Costs	
WWTP Upgrade and Distribution	$ 33 M
Environmental Mitigation	$ NA
Total Capital Cost	$ 33 M
Operating Costs	
Labor	$110,000
Power	$120,000
U.V. Lamps	$ 50,000
Chemicals, Membrane Replace	$120,000
Total Annual Operating Cost	$ 0.4 M
Annual Costs	
Annualized Capital Costs	$ 2.4 M
Operating Costs	$ 0.4 M
Total Annual Cost	$ 2.8 M

2.2.1 Basis for Cost Estimates

Capital Costs:

- WWTP Upgrades and Distribution Facilities: Capital costs associated with the WWTP upgrades for Phase I were based on the CH2MHILL 2003 RW report.

- Environmental Mitigation: Mitigation costs would be limited to the cost of environmental documentation, measures to reduce environmental impacts, and acquisition of permits, if any, and may range from one to two percent of the total capital costs of individual concept development. Environmental mitigation has not been included as a separate line item.

Operating Costs: Operating costs associated with the WWTP upgrades for Phase I were based on the CH2MHILL 2003 RW report.

Annual Costs: Lifecycle costing based on 30-year life project at 6% interest. It should be noted that the report used a 20-year life project at 6% interest. Therefore the annualized capital cost in the report ($2.6) varied slightly with the annualized cost ($2.4) used in this concept to determine the unit cost. The 30-year life project was used to remain consistent with the other project concepts analyzed for this study.

2.3 Outstanding Issues and Questions

None.

3.0 Burlingame Recycled Water Project (up to 4,400 AFY)

3.0 Concept Overview

3.0.1 Description

The City of Burlingame currently generates 0.25 mgd (275 AFY) of recycled water for internal use at the City's wastewater treatment plant including for equipment washdowns and cleaning. The City is considering expanding recycled water production to 4 mgd (4,400 AFY) for unrestricted park landscaping and large landscaping uses involving customers located in the Bay front area.

Burlingame Recycled Water Project

Yield

Supply Yield	up to 4,400 AFY
Quality Yield	0 AFY

Cost

Capital Cost	$18-20 M
O&M Cost	$0.3-0.4 M/yr
Unit Cost	$365-420 /AF

Partners

BAWSCA, Burlingame, Millbrae, SFO

3.0.2 Potential Partners and Supply Amounts

At this time potential partners for the Burlingame Recycled Water Project could possibly include BAWSCA, the City of Millbrae and the SF Airport. This concept would provide a new source of supply to existing users, potentially freeing up dry-year supplies for other users. Potential partners are listed in Table E3-5.

Table E3-5
Potential Partner and Supply Amounts

Partner	*Type of Benefit*	*Potential Amount (AFY)*	*Notes/Issues*
Burlingame	Dry-year supply reliability	TBD	
Millbrae	Dry-year supply reliability	TBD	
San Francisco Airport	Dry-year supply reliability	TBD	
Total		Up to 4, 400 AFY	

Dry-Year Supply

The total available dry-year supply for the concept is 4,400 AFY, calculated as the total usage identified by Burlingame Staff, June 2004.

Average Year Water Quality

No water quality data is available for this project concept.

Other Potential Partners Considered but Not Included

No other potential partners were considered for this concept.

3.0.3 Operating Description

The Burlingame Wastewater Treatment Plant would be upgraded to produce recycled water suitable for unrestricted use. Distribution piping would be constructed to convey the recycled water from the WWTP customers located in Burlingame and possibly adjacent areas of Millbrae and the San Francisco Airport.

3.1 Project Facilities

Table E3-6 summarizes the proposed facilities for this concept.

Table E3-6
Project Facilities for Burlingame-Recycled Water Irrigation Concept

Facility	***Notes***
Burlingame Wastewater Treatment Plant • Tertiary treatment plant (4 mgd)	Existing plant would be upgraded to produce Title 22 recycled water.
Pipelines • Distribution piping	Piping alignments assumed to follow public rights of way.

Basis for Facility Sizing

Preliminary sizing of the WWTP tertiary treatment process capacity (4 mgd) is based on the volume of average inflow at the wastewater treatment plant. A detailed study is planned to examine the feasibility and sizing of the facility.

3.2 Project Costs

Table E3-7 summarizes project capital, operating and annualized costs for the Burlingame project.

Table E3-7
Estimated Project Costs

North Concord	
Capital Costs	
WWTP Upgrade and Distribution	$ 18-20 M
Total Capital Cost	$ 18-20 M
Operating Costs	
Labor	$
Power	$
Chemicals, Membrane Replace, Misc. Maintenance	$
Total Annual Operating Cost	$ 0.37-0.42 M
Annual Costs	
Annualized Capital Costs	$ 0.1.3-1.5 M
Operating Costs	$ 0.37-0.42 M
Total Annual Cost	$ 1.7-1.9 M

3.2.1 Basis for Cost Estimates

Capital Costs:

- WWTP Upgrades and Distribution Facilities: Capital costs were based on the estimates provided by Burlingame Staff, June 2004.
- Environmental Mitigation: Mitigation costs would be limited to the cost of environmental documentation, measures to reduce environmental impacts, and acquisition of permits, if any, and may range from one to two percent of the total capital costs of individual concept development. Environmental mitigation has not been included as a separate line item.

Operating Costs: Operating costs were provided by Burlingame Staff, June 2004.

Annual Costs: Lifecycle costing based on 30-year life project at 6% interest.

3.3 Outstanding Issues and Questions

- Project partners need to verified and confirmed

4. CCCSD-Industrial Recycled Water Project (17,920 AFY)

4.0 Concept Overview

4.0.1 Description

The CCCSD-Industrial Recycled Water Project would provide advanced treatment of recycled water for industrial use at the Tesoro Power Plant, Foster Wheeler cogen facility, the Equilon Refinery (formerly Shell Martinez) and Rhoida (formerly Rhone-Poulenc).

CCCSD-Industrial Recycled Water *Project*

Tesoro (CCWD)

Yield

Supply Yield................. up to 8,960 AFY
Quality Yield ....0 AFY

Cost

Capital Cost .... $13.5 M
O&M Cost .... $1.4 M/yr
Unit Cost................................. $270/AF*

Other (Foster Wheeler, Equilon, Rhodia)

Yield

Supply Yield................ up to 8,960 AFY
Quality Yield ....0 AFY

Cost

Capital Cost .... $21.3 M
O&M Cost ....$530 K/yr
Unit Cost................................. $230/AF*

4.0.2 Potential Partners and Supply Amounts

The concept would require a partnership between CCCSD and Contra Costa Water District (CCWD), and other interested parties. The project would help to free up high quality drinking water supplies currently being used as process water at the industrial facilities. Table E3-8 provides a summary of the potential partners and long-term supply amounts.

Table E3-8
Potential Partner and Supply Amounts

Partner	***Type of Benefit***	***Potential Amount (AFY)***	***Notes/Issues***
Tesoro (CCWD)	Dry-year supply reliability	8,690 AFY	Potential to free up CCWD potable water supplies for increased dry-year supply reliability.
Other Industrial	Dry-year supply reliability	8,690 AFY	Potential to free up CCWD potable water supplies for increased dry-year supply reliability.
Total		**17,920 AFY**	

Dry-Year Supply

The total available dry-year supply for the concept is 17,920 AFY (CCCSD Staff, June 2004).

The dry year supply may diminished if:

- CCWD's allocation of water from the Central Valley Project is reduced because of the availability of recycled water

- A potable back-up supply is required from CCWD.

Average Year Water Quality

Table E3-9 displays average recycled water quality currently produced at CCCSD facilities.

Table E3-9 - Average Recycled Water Quality, CCCSD

Constituent	***Concentration at Filter Plant (mg/l)***	***Requirement (mg/l)***
TDS	480	550
Hardness as $CaCo_3$	222	40-125
BOD_5	5.5	5
TSS	9.4	10
NO_3	.5	Not Provided
NO_2	1.2	Not Provided
NH_3	20	Not Provided
PH	7.5	6.5-8.0

From *Preliminary Cost Estimate for the Industrial Recycled Water Project, RBF Consulting, February 2002.*

Other Potential Partners Considered but Not Included

No other potential partners were considered for this concept.

4.0.3 Operating Description

Recycled water would be produced at CCCSD's Recycled Water Plant. Before sending water to the Filter Plant, water would be sent through a Biofor reactor (Biological Filtration Oxygenated Reactor) to remove ammonia which can be detrimental to industrial users (RBF, 2002). By 2010 it is proposed that up to 16 MGD of water will serve additional needs at Tesoro along with Foster Wheeler (a co-gen plant that sells power to Tesoro), Equlion Refinery and Rhodia. Recycled water would be conveyed through existing transmission facilities to Tesoro and Equlion. An additional 2 miles of pipeline would be needed to connect Rhodia (CCCSD Staff, June 2004).

4.1 Project Facilities

Table E3-10 summarizes the proposed facilities for this concept.

Table E3-10
Project Facilities for CCCSD-Recycled Water Irrigation Concept

Facility	***Notes***
CCCSD Martinez Wastewater Treatment Plant • U.V. Filtration	Treats water to secondary standards.
CCCSD Biofor Reactor • 16 MGD	Removes ammonia for industrial use
CCCSD Recycled Water Filter Plant • Storage (2,500 Gal) • Coagulant metering pumps	Treats water to Title 22 Standards
Clearwell • Install baffles	
Pipelines • Install cathodic protection for 42 inch pipe to Tesoro • 2 mile pipe to Rhoida	Pipeline assumed to follow right of way.

Basis for Facility Sizing

The CCCSD facilities would be sized to treat up to 17, 920 AFY.

4.2 Project Costs

Table E3-11 summarizes project capital, operating and annualized costs.

Table E3-11
Estimated Project Costs

Tesoro	
Capital Costs	
Biofor Reactor	$ 4.8 M
Distribution Piping Modifications	$7.9 M
Other	$0.8 M
Total Capital Cost	$ 13.5 M*
Operating Costs	
Total Annual Operating Cost	$ 1.4 M
Annual Costs	
Annualized Capital Costs	$ 1 M*
Operating Costs	$ 1.4 M
Total Annual Cost	$ 2.4 M
Other Industrial	
Capital Costs	
Distribution Piping	$ 21.3 M *
Total Capital Cost	$ 21.3 M
Operating Costs	$
Total Annual Operating Cost	$ 0.53 M
Annual Costs	
Annualized Capital Costs	$ 1.55 M*
Operating Costs	$ 0.53M
Total Annual Cost	$ 1.98 M

Notes:

Project costs do not include potential duplication of service charge.

4.2.1 Basis for Cost Estimates

- Capital costs associated with the Tesoro project were taken from the Industrial Reuse Project Cost Estimate (RBF, February 2002). Capital costs for the other industrial projects were provided by CCCSD Staff (June 2004). This cost was given as $34.8 M total (including Tesoro). Therefore the Tesoro cost was subtracted to obtain $21.3 for the other industrial projects.

- Environmental Mitigation: Mitigation costs would be limited to the cost of environmental documentation, measures to reduce environmental impacts, and acquisition of permits, if any, and may range from one to two percent of the total capital costs of individual concept development. Environmental mitigation has not been included as a separate line item.

- Operating Costs: Operating costs associated with the Tesoro Project were provided in the Industrial Reuse Project Cost Estimate (RBF, February 2002). Operating costs associated with the other industrial projects were estimated at 2.5% (the average of the operating costs from the other projects).

- Annual Costs: Lifecycle costing based on 30-year life project at 6% interest.

4.3 Outstanding Issues and Questions

- Need to confirm project partners.

- May need to increase Filter Plant Capacity if both irrigation and industrial projects are completed, but do not know sequencing of projects and therefore when additional filtration capacity may be needed.

- Other potential project costs including back-up facilities and duplication of service charges

- Need to confirm process water requirements of the potential industrial project partners.

5. CCCSD-Recycled Water Irrigation Projects (3,000 AFY)

5.0 Concept Overview

5.0.1 Description

Central Contra Costa Sanitary District (CCCSD) has developed recycled water plans for irrigation and industrial uses. This concept describes the potential treatment and conveyance of recycled water for irrigation in North Concord and Walnut Creek. Currently CCCSD supplies about 600 AFY of recycled irrigation water to golf courses, a community college, an elementary school, two middle schools, a high school and the City of Pleasant Hill. This concept proposes an additional 3,000 AFY (North Concord: 1,000 AFY, Walnut Creek: 2,000 AFY) of recycled water for irrigation (CCCSD Staff, June 2004).

CCCSD Recycled Water Irrigation Project

North Concord

Yield

Supply Yield.................. up to 1,000 AFY
Quality Yield ....0 AFY

Cost

Capital Cost.....................................$4.4 M
O&M Cost......................................$110 K/yr
Unit Cost.. $430 /AF

Walnut Creek

Yield

Supply Yield.................. up to 2,000 AFY
Quality Yield ....0 AFY

Cost

Capital Cost...................................$22.2 M
O&M Cost.......................................$550 K/yr
Unit Cost...................................... $1080 /AF

Partners

CCWD, EBMUD

5.0.2 Potential Partners and Supply Amounts

This concept would extend the distribution system to include additional irrigation users. In addition a $7.7 M intertie could be constructed to connect Shell Oil Pipeline to the existing Recycled Water Main Line to improve system reliability. The existing CCCSD recycled water facilities which treat water to Title 22 Standards would be used for this concept.

Table E3-12
Potential Partner and Supply Amounts

Partner	*Type of Benefit*	*Potential Amount (AFY)*	*Notes/Issues*
EBMUD	Dry-year supply reliability	TBD	
CCWD	Dry-year supply reliability	TBD	
Total		3,000 AFY	

Dry-Year Supply

The total available dry-year supply for the concept is 3,000 AFY, calculated as the total irrigation usage identified by CCCSD Staff, June 2004.

Dry year supply may be diminished if:

- CCWD's allocation of water from the Central Valley Project is reduced because of the availability of recycled water.
- A potable back-up supply is required of CCWD.

Average Year Water Quality

Table E3-13 displays average recycled water quality currently produced at CCCSD facilities.

Table E3-13
Average Recycled Water Quality, CCCSD

Constituent	***Concentration at Filter Plant (mg/l)***	***Requirement (mg/l)***
TDS	480	550
Hardness as $CaCo_3$	222	40-125
BOD_5	5.5	5
TSS	9.4	10
NO_3	.5	Not Provided
NO_2	1.2	Not Provided
PH	7.5	6.5-8.0

From *Preliminary Cost Estimate for the Industrial Recycled Water Project, RBF Consulting, February 2002.*

Other Potential Partners Considered but Not Included

No other potential partners were considered for this concept.

5.0.3 Operating Description

CCCSD facilities will be used to treat the recycled water. Wastewater first undergoes rigorous treatment including U.V. Disinfection at the CCCSD Wastewater Treatment Plant in Martinez after which most of it is discharged into Suisun Bay. Water to be used for irrigation is sent to CCCSD's Recycled Water Filter Plant where it undergoes additional filtration and disinfection to meet Title 22 standards.

5.1 Project Facilities

Table E3-14 summarizes the proposed facilities for this concept.

Table E3-14
Project Facilities for CCCSD-Recycled Water Irrigation Concept

Facility	***Notes***
CCCSD Martinez Wastewater Treatment Plant • U.V. Filtration	Treats water to secondary standards.
CCCSD Recycled Water Filter Plant	Existing plant produces Title 22 Recycled Water
Pipelines • Distribution piping	Piping alignments assumed to follow public rights of way.

Basis for Facility Sizing

The CCCSD plant is already sized to accommodate this project.

5.2 Project Costs

Table E3-15 summarizes project capital, operating and annualized costs for the North Concord and Walnut Creek projects.

Table E3-15
Estimated Project Costs

North Concord	
Capital Costs	
WWTP Upgrade and Distribution	$ 4.4 M
Total Capital Cost	$ 4.4 M
Operating Costs	
Labor	$
Power	$
Chemicals, Membrane Replace, Misc. Maintenance	$
Total Annual Operating Cost	$ 0.11 M
Annual Costs	
Annualized Capital Costs	$ 0.32 M
Operating Costs	$ 0.11 M
Total Annual Cost	$ 0.43 M
Walnut Creek	
Capital Costs	
WWTP Upgrade and Distribution	$ 22.2 M
Total Capital Cost	$ 22.2 M
Operating Costs	
Labor	$
Power	$
Chemicals, Membrane Replace, Misc. Maintenance	$
Total Annual Operating Cost	$ 0.56 M
Annual Costs	
Annualized Capital Costs	$ 1.61 M
Operating Costs	$ 0.56 M
Total Annual Cost	$ 2.17 M

Notes:

- Costs do not include potential duplication of service charges.

5.2.1 Basis for Cost Estimates

Capital Costs:

- WWTP Upgrades and Distribution Facilities: Capital costs were based on the estimates provided by CCCSD Staff in June 2004. Cost for the $7.7 M intertie are not included in the capital cost estimates.

- Environmental Mitigation: Mitigation costs would be limited to the cost of environmental documentation, measures to reduce environmental impacts, and acquisition of permits, if any, and may range from one to two percent of the total capital costs of individual concept development. Environmental mitigation has not been included as a separate line item.

Operating Costs: Operating costs were assumed to be 2.5% of capital costs, as this is the upper average of operating costs for concepts were actual estimates were provided.

Annual Costs: Lifecycle costing based on 30-year life project at 6% interest.

5.3 Outstanding Issues and Questions

- None.

6. Coastside County Water District Recycled Water Project (580 AFY)

6.0 Concept Overview

6.0.1 Description

Coastside County Water District (CCWD) currently does not produce recycled water but has identified the feasibility of supplying recycled water from the Sewer Authority Mid-Coastside (SAM) Wastewater Treatment Facility (WWTP) for irrigation in the Half Moon Bay area. This proposed concept project would provide up 580 AFY of recycled water supply for irrigation uses at two golf courses in Ocean Colony and the Skylawn Memorial Park Cemetery (Carollo, 2003).

Coastside County Recycled Water

Yield
Supply Yield .... up to 580 AFY
Quality Yield .... 0 AFY

Cost
Capital Cost................................$10.8 M
O&M Cost................................ $410 K/yr
Unit Cost .... $2,100 /AF/yr

Potential Partners
Coastside CWD, BAWSCA, Ocean Colony, Skylawn Memorial Park Cemetery

6.0.2 Potential Partners and Supply Amounts

This concept would require a partnership between the SAM WWTP, Coastside County Water District, and the potential users of recycled water. This concept would provide a new source of supply to existing users, potentially freeing up dry-year supplies for other users.

Table E3-16
Potential Partner and Supply Amounts

Partner	***Type of Benefit***	***Potential Amount (AFY)***	***Notes/Issues***
Ocean Colony	Dry-year supply reliability	430 AFY	Potential to reduce environmental effects of current discharge into Pacific Ocean.
Skylawn Memorial Park Cemetery	Dry-year supply reliability	150 AFY	Potential to reduce environmental effects of current discharge into Pacific Ocean.
	Total	**580 AFY**	

Dry-Year Supply

The total available dry-year supply for the concept is 580 AFY.

Average Year Water Quality

There is no water quality benefit associated with this concept.

Other Potential Partners Considered but Not Included

No other potential partners were considered for this concept.

6.0.3 Operating Description

Recycled water would be produced at the SAM WWTP and distributed to two irrigation users: Ocean Colony golf courses, located near the Pacific Ocean and Skylawn Memorial Park Cemetery, located east and inland of the SAM WWTP. Two main pipelines would be constructed to deliver water to the irrigation users.

6.1 Project Facilities

Table E3-17 summarizes the proposed facilities for this concept.

Table E3-17
Project Facilities for Coastside County Recycled Water

Facility	*Notes*
SAM WWTP • Coagulation/Flocculation • Filtration • Increased Disinfection (UV or Chlorine)	The current WWTP needs to be upgraded from secondary to tertiary treatment. Some facilities in the current WWTP (such as an unused sedimentation basin) may be converted to serve some of the tertiary treatment needs.
Storage • 250,000 Gal	Storage will take place in existing, unused 250,000 gal aeration basin.
Recycled Water Pump Station • Vertical turbine pumps	Pump station will pump recycled water to golf courses (3 miles) and cemetery (5 miles).
Booster Pump Stations	
Distribution • Distribution pipelines	10-inch diameter PVC pipe and 8-inch diameter steel pipe will deliver water to users. It is assumed that pipeline alignments would follow public rights-of way. These will constitute the major capital cost for the project.

Basis for Facility Sizing

The sizing is based on estimated available supply.

6.2 Project Costs

Table E3-18 summarizes project capital, operating and annualized costs.

Table E3-18
Estimated Project Costs

Capital Costs	
Flocculation/Coagulation	$200 K
Tertiary Filtration	$600 K
Chlorine Contact Basin	$75 K
On-Site Storage	$ 40
Recycled Water Pump Station	$ 425 K
Other Facility Costs	$ 4.76 M
Recycled Water Pipeline	$4.7 M
Total Capital Cost	$ 10.8 M
Operating Costs	
Total Annual Operating Cost	$ 0.41 M
Annual Costs	
Annualized Capital Costs	$ .8 M
Operating Costs	$ 0.41 M
Total Annual Cost	$ 1.21 M

Basis for Cost Estimates

- Capital Costs: Capital costs associated with the WWTP upgrades and distribution pipelines were extracted from the *Water Reclamation Program Preliminary Economic Feasibility Study*, August 2003 (Carollo, 2003).

- O&M Costs: Operating costs were extracted from the *Water Reclamation Program Preliminary Economic Feasibility Study*, August 2003 (Carollo, 2003).

- Environmental Mitigation: Mitigation costs would be limited to the cost of environmental documentation, measures to reduce environmental impacts, and acquisition of permits, if any, and may range from one to two percent of the total capital costs of individual concept development. Environmental mitigation has not been included as a separate line item.

- Annual Costs: Lifecycle costing based on 30-year life project at 6% interest. Note, the annual costs in this concept (and therefore the unit costs) differ from those provided in the Carollo, 2003 report because a different lifecycle costing was used. In order to remain consistent with the other concepts the annual capital costs was re-calculated using the 30 year life project at 6% interest.

6.3 Outstanding Issues and Questions

- Need to confirm project partners.

7. Expanded DDSD Recycled Water Project (1,600 AFY)

7.0 Concept Overview

7.0.1 Description

Delta Diablo Sanitation District (DDSD) currently supplies 8,600 AFY of recycled water for use as cooling tower supply for two power plants and for irrigation of over 20 acres of parks and landscaped areas (DDSD, 2004). This proposed concept would provide an additional 1,600 AFY of recycled water supply for urban landscape projects and irrigation uses in DDSD's service area. These potential users include the Pittsburg City Hall and various golf courses (Baatrup, 2004).

Expanded DDSD Recycled Water Project

Yield
Supply Yield................. up to 1,600 AFY
Quality Yield ....0 AFY

Cost
Capital Cost....................................$8 M
O&M Cost................................$200 K/yr
Unit Cost.........................$250-500/AF/yr

Potential Partners
CCWD

7.0.2 Potential Partners and Supply Amounts

This concept would require a partnership between DDSD and other interested parties. Contra Costa Water District would only be a partner if the project were expanded further. This project would help to conserve higher quality water for drinking water supplies. Table E3-19 provides a summary of the potential partners and long-term supply amounts.

Table E3-19
Potential Partner and Supply Amounts

Partner	*Type of Benefit*	*Potential Amount (AFY)*	*Notes/Issues*
Industrial and Irrigation Users (CCWD)	Dry-year supply reliability	1,600 AFY	Provides up to 1,600 AFY of supply to industrial and irrigation users. Potential to free up CCWD potable water supplies.

Dry-Year Supply

The total available dry-year supply for the concept is 1,600 AFY.

The dry year supply is diminished if:

- CCWD's allocation of water from the Central Valley Project is reduced because of the availability of recycled water.
- A potable back-up supply is required from CCWD.

Average Year Water Quality

There is no water quality benefit associated with this concept.

Other Potential Partners Considered but Not Included

No other potential partners were considered for this concept.

7.0.3 Operating Description

Recycled water would be produced at DDSD's Recycled Water Facility (RWF) and distributed to irrigation users in the City of Pittsburg and other areas.

7.1 Project Facilities

Table E3-20 summarizes the proposed facilities for this concept.

Table E3-20
Project Facilities for Expanded DDSD Recycled Water Concept

Facility	***Notes***
DDSD Recycled Water Facility • No modifications needed	The current RW Facility has capacity to treat 12.4 MGD while at the present it treats 7.6 MGD, therefore no plant modifications are needed.
Distribution • Distribution pipelines	It is assumed that pipeline alignments would follow public rights-of way. These will constitute the major capital cost for the project.

Basis for Facility Sizing

The DDSD RWF was designed to accommodate 12.4 MGD therefore no modifications are necessary.

7.2 Project Costs

Table E3-21 summarizes project capital, operating and annualized costs.

Table E3-21
Estimated Project Costs

Capital Costs	
Total Capital Cost	$ 8 M
Operating Costs	
Total Annual Operating Cost	$ 0.2 M
Annual Costs	
Annualized Capital Costs	$ 8 M
Operating Costs	$ 0.2 M
Total Annual Cost	$ 8 M

Basis for Cost Estimates

- Capital Costs: Capital costs associated with the WWTP upgrades were based on personal conversations with Greg Baatrup (DDSD) on May 28, 2004.
- O&M Costs: Operating costs are based on information from other recycled water projects in the Bay Area that mainly involve expansions of pipelines and reservoirs operating costs were conservatively assumed to be 2.5% of capital costs.

- Environmental Mitigation: Mitigation costs would be limited to the cost of environmental documentation, measures to reduce environmental impacts, and acquisition of permits, if any, and may range from one to two percent of the total capital costs of individual concept development. Environmental mitigation has not been included as a separate line item.

- Annual Costs: Lifecycle costing based on 30-year life project at 6% interest.

7.3 Outstanding Issues and Questions

None.

8. Expanded DERWA Recycled Water Project (1,430 AFY)

8.0 Concept Overview

8.0.1 Description

Expanded DERWA Recycled Water Project

Yield
Supply Yield......................... up to 1,430
Quality Yield ....0 AFY

Cost
Capital Cost................................ $4.1 M
O&M Cost...............................$102 K/yr
Unit Cost...............................$285 AF/yr

Potential Partners
EBMUD, DSRSD (Zone 7)

DERWA is a Joint Powers Authority between Dublin San Ramon Services District (DSRSD) and East Bay Municipal Utilities District (EBMUD). As part of the San Ramon Valley Recycled Water Program, DERWA has begun construction on a long-term water recycled project to eventually produce 5.7 mgd (6,390 AFY) of recycled water for use by customers in portions of Blackhawk, Danville, Dublin and San Ramon. The recycled water would be used for irrigation of golf courses, parks, common planted areas within homeowners associations, roadway medians, greenbelts, schools and office complexes (DSRSD, 2004). This concept describes the portion of the backbone facilities for which DERWA is responsible. The distribution facilities EBMUD is responsible for are described in Concept 9, Expanded San Ramon Valley Project.

At this time, the DERWA project has been divided into two phases. Construction of Phase I started in 2003 and is expected to be completed in mid-2005 (EBMUD, 2004). This first phase, which has already been financed at a cost of $81 million, will result in an additional 3,696 AFY of recycled water. This concept involves Phase II of the project for the DSRSD portion, which will provide an additional 1,430 AFY at a cost of $4.1 M. Phase II has not been financed and will depend on outside funding to proceed with planning and future construction.

8.0.2 Potential Partners and Supply Amounts

This concept involves a partnership between DSRSD and EBMUD, and other interested parties. Table E3-22 provides a summary of the potential partners and long-term supply amounts.

Table E3-22
Potential Partner and Supply Amounts

Partner	*Type of Benefit*	*Total Potential Amount (AFY)*	*Notes/Issues*
DSRSD (Zone 7)	Expanded RW customer base	1,430 AFY	This is an estimate verified by DERWA.
EBMUD	Expanded RW customer base	1,430 AFY	This is an estimate verified by DERWA.
Total		1,430 AFY	

Dry-Year Supply

The total available dry-year supply for the concept at complete build-out is 1,430 AFY (DERWA, 2004).

Average Year Water Quality

There is no water quality benefit associated with this concept.

Other Potential Partners Considered but Not Included

No other potential partners were considered for this concept.

8.0.3 Operating Description

Recycled water would be produced at a recycled water facility located at the existing DSRSD wastewater treatment plant located in Pleasanton, California.

8.1 Project Facilities

Table E3-23 summarizes the proposed facilities for this concept (EBMUD, 2004).

Table E3-23
Project Facilities for Expanded DERWA Recycled Water Concept

Facility	*Notes*
DSRSD Recycled Water Plant • Upgraded RW Facilities including Filtration, UV, and additional chemical disinfection	RW facilities to be expanded in Phase II from 9.7 MGD to 16.5 MGD peak flow capacity.
Pipelines • Additional pipelines and transmission to customers	It is assumed that pipeline alignments would follow public rights-of way.

Basis for Facility Sizing

The facility components were described by Robert Baker (Baker, 2004).

8.2 Project Costs

Table E3-24 summarizes project capital, operating and annualized costs for Phase II of the DERWA Project.

Table E3-24
Estimated Project Costs

Capital Costs	
WWTP Upgrades and Piping	$ 4.1 M
Environmental Mitigation	$ --
Total Capital Cost	$ 4.1 M
Operating Costs	
Total Annual Operating Cost	$ 102,000
Annual Costs	
Annualized Capital Costs	$ 300,000
Operating Costs	$ 102,000
Total Annual Cost	$ 402,000

Basis for Cost Estimates

- Capital Costs: Capital costs associated with this project are based on preliminary unit costs from DSRSD. The capital cost was calculated by extrapolating the unit costs and factoring in the O&M (assumed 2.5% of capital).
- Environmental Mitigation: Mitigation costs would be limited to the cost of environmental documentation, measures to reduce environmental impacts, and acquisition of permits, if any, and may range from one to two percent of the total capital costs of individual concept development. Environmental mitigation costs are assumed to be included in the DERWA estimate and have not been broken out separately.
- Operating Costs: Operating costs are based on information from other recycled water projects in the Bay Area that mainly involve expansions of pipelines and reservoirs. Operating costs were conservatively assumed to be 2.5% of capital costs. These costs need to be confirmed when estimates are available.
- Annual Costs: Lifecycle costing based on 30-year life project at 6% interest.

8.3 Outstanding Issues and Questions

None.

9. Expanded San Ramon Valley Recycled Water Project (up to 1,904 AFY)

9.0 Concept Overview

9.0.1 Description

Expanded San Ramon Valley Recycled Water Project

Yield

Supply Yield	up to 1,094 AFY
Quality Yield	0 AFY

Cost

Capital Cost	$25 M
O&M Cost	$625 K
Unit Cost	$1,285

Potential Partners
DSRSD, Cities of Blackhawk, Danville, Dublin and San Ramon.

The EBMUD San Ramon Valley Recycled Water Project (SRVRWP) is a three-phase project that will ultimately provide 2,688 AFY of recycled water to portions of Blackhawk, Danville, Dublin and San Ramon. Recycled water would be produced at the DERWA facilities and distributed to residential and industrial customers. DERWA is a Joint Powers Authority between Dublin San Ramon Services District (DSRSD) and East Bay Municipal Utilities District (EBMUD). Phase I of the project is under construction and is expected to provide 784 AFY of water by the spring of 2005.

The proposal for this concept involves Phase II and Phase III, which together will yield 1,094 AFY of recycled water. Planning has begun for Phase II and Phase III, which could begin as soon as 2005 and 2008, respectively. Neither Phase II nor Phase III has been financed and the ambitious schedule would depend largely on obtaining funding relatively soon.

9.0.2 Potential Partners and Supply Amounts

This concept expands on the existing partnership between EBMUD and DDSRD and would extend recycled water to multiple cities within EBMUD's service area.

Dry-Year Supply

The estimate for total available dry-year supply for the concept is up to 1,904 AFY (EBMUD Staff, 2004)

Average Year Water Quality

There is no water quality benefit associated with this concept.

Other Potential Partners Considered but Not Included

No other potential partners were considered for this concept.

9.0.3 Operating Description

Recycled water would be produced at a recycled water facility located at the existing DSRSD wastewater treatment plant located in Pleasanton, California. EBMUD will be responsible for construction distribution pipelines, pump stations, and a storage tank to convey water from the DERWA transmission system to District customers in Blackhawk, Danville, Dublin and San Ramon.

9.1 Project Facilities

TableE3-25 summarizes the proposed facilities for this concept (EBMUD, 2004).

Table E3-25
Project Facilities for Expanded SBWR Concept

Facility	***Notes***
Recycled Water facilities • DSRSD	
Distribution System Improvements • New Reservoirs • Upgrades to existing Pump Station • Pipeline extensions	 Needed to expand system delivery It is assumed that pipeline alignments will follow public rights-of-way

9.2 Project Costs

Table E3-26 summarizes project capital, operating and annualized costs.

Table E3-26
Estimated Project Costs

Capital Costs	
Advanced Treatment	$ TBD
Capital Facilities	$ TBD
Total Capital Cost	$ 25 M
Operating Costs	
Total Annual Operating Cost	$ 0.625 M
Annual Costs	
Annualized Capital Costs	$ 1.82 M
Operating Costs	$ 0.625 M
Total Annual Cost	$ 2.5 M

Basis for Cost Estimates

- Capital Costs: Capital costs were provided by EBMUD Staff (August 2004).

- Environmental Mitigation: Mitigation costs would be limited to the cost of environmental documentation, measures to reduce environmental impacts, and acquisition of permits, if any, and may range from one to two percent of the total capital costs of individual concept development. Environmental mitigation has not been included as a separate line item.

- Operating Costs: Operating costs were developed assuming 2.5% of capital costs. This percentage is based on O&M figures for other Bay Area concepts. The unit costs was then developed by summing the yearly operating and annualized capital costs and dividing by the yield 1,094 AFY.

- Annual Costs: Lifecycle costing based on 30-year life project at 6% interest.

9.3 Outstanding Issues and Questions

- Unit cost estimates based on RMC approximations. Once updated figures are released the costs need to be updated.

- Need to confirm project partners

10.0 Expanded East Bayshore Water Recycling Project (up to 2,016 AFY)

10.0 Concept Overview

10.0.1 Description

The East Bayshore Project is a three-phase project initiated by EBMUD that would provide a total 2,800 AFY of recycled water to portions of Alameda, Albany, Berkeley, Emeryville and Oakland. The first phase of the project has already been financed and will provide an average of 784 AFY by 2005. Tertiary treatment facilities at the EBMUD wastewater treatment plant near the Bay Bridge in Oakland are being planned and will be built in the first phase. The first phase will provide recycled water to commercial and industrial customers in Oakland, Berkeley, Emeryville and Albany. In addition, recycled water will be made available for wetland restoration.

Expanded East Bayshore Project

Yield

Supply Yield	up to 2,016 AFY
Quality Yield	0 AFY

Cost

Capital Cost	$20-24 M
O&M Cost	$500-600 K
Unit Cost	$970-$1,165

Potential Partners
EBMUD, Cities of Alameda, Albany, Berkeley, Emeryville, Oakland, Zone 7

The second and third phases (Phase IB and Phase 2) will provide an additional 2,016 AFY. This project concept describes water recycling project plans these future phases (Phase IB and Phase 2). The work involved includes expanding treatment capacity at the future planned recycled water facilities at the Oakland wastewater treatment plant and extending distribution lines to Alameda and additional customers in Oakland, Berkeley, Emeryville and Albany. Construction for Phase IB is expected to begin 2009 and for Phase 2 in 2013. Neither Phase IB or Phase 2 have been financed and therefore both are contingent upon securing additional funds.

10.0.2 Potential Partners and Supply Amounts

This concept is a regional project that would extend recycle water service to five cities within EBMUD's service area. This concept would potentially further conserve potable water supplies from EBMUD and would allow for additional reduction in wastewater discharge to the Bay (thereby preserving the salt marsh ecosystem). Table E3-27 provides a summary of the potential partners and long-term supply amounts for Phase IB and Phase 2.

Table E3-27
Potential Partner and Supply Amounts

Potential Partner	***Type of Benefit***	***Potential Amount (AFY)***	***Notes/Issues***
EBMUD	Dry-year supply reliability	TBD	
City of Alameda	Dry-year supply reliability	TBD	
City of Albany	Dry-year supply reliability	TBD	
City of Berkeley	Dry-year supply reliability	TBD	
City of Emeryville	Dry-year supply reliability	TBD	
City of Oakland	Dry-year supply reliability	TBD	
Zone 7	Dry-year supply reliability	TBD	
Total		2,016 AFY	

Dry-Year Supply

The estimate for total available dry-year supply for the concept is up to 2,016 AFY (EBMUD Staff, 2004).

Average Year Water Quality

There is no water quality benefit associated with this concept.

Other Potential Partners Considered but Not Included

No other potential partners were considered for this concept.

10.0.3 Operating Description

Recycled water would be produced at the new EBMUD recycled water facility at the Oakland WWTP near the Bay Bridge. The expanded phases would involve expanding recycled water facilities, extending the distribution network and additional customer retrofits.

10.1 Project Facilities

Table E3-28 summarizes the proposed facilities for this concept (SCVWD, 2004).

Table E3-28
Project Facilities for Expanded SBWR Concept

Facility	*Notes*
Recycled Water facilities • EBMUD Oakland Plant	Increase treatment capacity
Distribution System Improvements • Addition distribution lines • Customer Retrofits	It is assumed that pipeline alignments will follow public rights-of-way

10.2 Project Costs

Table E3-29 summarizes project capital, operating and annualized costs.

Table E3-29
Estimated Project Costs

Capital Costs	
Advanced Treatment	$ TBD
Capital Facilities	$ TBD
Total Capital Cost	$ 20-24 M
Operating Costs	
Total Annual Operating Cost	$ 500-600 K
Annual Costs	
Annualized Capital Costs	$ 1.45-1.74 M
Operating Costs	$ 0.5-0.6 M
Total Annual Cost	$ 1.95-2.34

Basis for Cost Estimates

- Capital Costs: Capital costs were provided by EBMUD Staff (August, 2004).
- Environmental Mitigation: Mitigation costs would be limited to the cost of environmental documentation, measures to reduce environmental impacts, and acquisition of permits, if any, and may range from one to two percent of the total capital costs of individual concept development. Environmental mitigation has not been included as a separate line item.
- Operating Costs: Operating costs were not available. Current O&M was developed assuming 2.5% of capital costs. This percentage is based on average O&M costs for other Bay Area concepts.
- Annual Costs: Lifecycle costing based on 30-year life project at 6% interest.

10.3 Outstanding Issues and Questions

- O&M and unit costs were based on RMC approximations. Once updated figures are released the costs need to be updated.

- Project partners have not been confirmed by EBMUD.

11. Expanded South Bay Water Recycling (SBWR) Project (up to 16,800 AFY)

11.0 Concept Overview

Expanded SBWR Project

Yield
Supply Yield............... up to 16,800 AFY
Quality Yield ....0 AFY

Cost
Capital Cost......................... $208-241 M
O&M Cost................................. $5.2-6 M
Unit Cost............................ $1200-$1400

Cost figures are being developed by RMC for SBWR and will be available Summer 2004.

Potential Partners
Santa Clara, San Jose, and Milpitas
(SCVWD, SFPUC, BAWSCA)

11.0.1 Description

Currently the South Bay Water Recycling (SBWR) project provides over 5,000 AFY of recycled water to various residential and industrial users. Phase I of the project was completed in 1999 at a cost of $140 Million. It included the construction of 60 miles of pipeline, four pump stations and a reservoir. The beginning of Phase II was approved in 2001 at a cost of $82.5 Million and construction and planning is currently underway. This concept proposal involves implementing the remaining elements that have not already been financed. Expansion of pipelines into Santa Clara and Milpitas, construction of the Silver Creek Pipeline into Coyote Valley (South San Jose) and additional reservoirs are all proposed for Phase II (SCVWD, 2004). The project overall cost of $208-$241 Million does not include advanced treatment or expansion of the recycled water production facilities.

The proposal for this concept would assist in the completion of Phase II (which will depend on additional funding) as well as extend the project to future phases to improve treatment and system reliability (SCVWD, 2004).

11.0.2 Potential Partners and Supply Amounts

This concept expands on the existing partnership between Santa Clara Valley Water District (SCVWD), and the cities of Santa Clara, San Jose, and Milpitas to include other interested parties such as SFPUC and BAWSCA. This concept would potentially further conserve potable water supplies from SCVWD and SFPUC, and would allow for additional reduction in wastewater discharge to the South Bay (thereby preserving the salt marsh ecosystem). Table E3-30 provides a summary of the potential partners and long-term supply amounts above and beyond those conceived in Phase II.

Table E3-30
Potential Partner and Supply Amounts

Potential Partner	***Type of Benefit***	***Potential Amount (AFY)***	***Notes/Issues***
Santa Clara (SCVWD, SFPUC, BAWSCA)	Dry-year supply reliability		Expanded project would potentially offset potable supplies from SFPUC or SCVWD and potentially increase dry year reliability.
San Jose (SCVWD, SFPUC, BAWSCA)	Dry-year supply reliability		Expanded project would potentially offset potable supplies from SFPUC or SCVWD and potentially increase dry year reliability.
Milpitas (SCVWD, SFPUC, BAWSCA)	Dry-year supply reliability		Expanded project would potentially offset potable supplies from SFPUC or SCVWD and potentially increase dry year reliability.
Total		16,800 AFY	

Dry-Year Supply

The estimate for total available dry-year supply for the concept is up to 16,800 AFY (Tilden, 2004). This yield represents a very rough estimate for future predicted recycled water production. The number does not include the planned 3,360 AFY to Metcalf Energy Center, as the financing and planning for this supply has already been completed. The 16,800 AFY figure is currently being refined and evaluated by RMC and SCVWD. A more accurate figure will be available Summer 2004.

Average Year Water Quality

There is no water quality benefit associated with this concept. On the contrary, there is a potential for groundwater degradation unless the recycled water has undergone advanced treatment prior to application.

Other Potential Partners Considered but Not Included

No other potential partners were considered for this concept.

11.0.3 Operating Description

Recycled water would be produced at the San Jose/Santa Clara Water Pollution Control Plant for distribution to new customers within San Jose, Santa Clara and Milpitas via new pipeline extensions to the existing system. A major pipeline would be constructed to extend service to Coyote Valley in south San Jose. Improved quality and reliability through advanced treatment, redundancy and power improvements would be a focus of the future phases. In addition, desalination would be included to further treat supplies to reduce high levels of TDS.

11.1 Project Facilities

Table E3-31 summarizes the proposed facilities for this concept (SCVWD, 2004).

Table E3-31
Project Facilities for Expanded SBWR Concept

Facility	***Notes***
Recycled Water facilities • San Jose/Santa Clara WPCP	Advanced treatment for salt and pollutant removal
Distribution System Improvements • New Reservoirs • Upgrades to existing Pump Station • Pipeline extensions into Santa Clara and Milpitas • Silver Creek Pipeline into Coyote Valley	Needed to improve system delivery reliability Needed to expand system delivery It is assumed that pipeline alignments will follow public rights-of-way

11.2 Project Costs

Table E3-32 summarizes project capital, operating and annualized costs.

Table E3-32
Estimated Project Costs

Capital Costs	
Advanced Treatment	$ TBD
Capital Facilities	$ TBD
Total Capital Cost	$ 208-241 M
Operating Costs	
Total Annual Operating Cost	$ 5.2-6 M
Annual Costs	
Annualized Capital Costs	$ 15.11-17.58 M
Operating Costs	$ 5.2-6 M
Total Annual Cost	$ 1.9-2.1 M

Basis for Cost Estimates

- Capital Costs: Capital costs were estimated using the average O&M cost for Bay Area RW concepts ($1,200-$1,400 per AF) and extrapolating. More accurate cost figures are being estimated by RMC in conjunction with SCVWD and will be available in the fall of 2004.

- Environmental Mitigation: Mitigation costs would be limited to the cost of environmental documentation, measures to reduce environmental impacts, and acquisition of permits, if any, and may range from one to two percent of the total capital costs of individual concept development. Environmental mitigation has not been included as a separate line item.

- Operating Costs: Operating costs will be available as well in fall of 2004. Current O&M was developed assuming 2.5% of capital. This percentage is based on O&M figures for other Bay Area concepts.

- Annual Costs: Lifecycle costing based on 30-year life project at 6% interest.

11.3 Outstanding Issues and Questions

- Cost estimates based on RMC approximations. Once updated figures are released the costs need to be updated.
- Public acceptance
- Institutional Arrangements
- Financing

12. Franklin Canyon Recycled Water Project (336 AFY)

12.0 Concept Overview

12.0.1 Description

Wastewater from the Pinole and Hercules treatment plants would be conveyed to a recycled water facility in the Hercules area and treated to produce 0.3 mgd (336 AFY). Recycled water would then be distributed to various users. Potential users include the Tosco Carbon Plant, Franklin Canyon Golf Course, and a variety of other irrigation and industrial users in the area (EBMUD, 2004).

Franklin Canyon Recycled Water Project

Yield
Supply Yield.................... up to 336 AFY
Quality Yield ....0 AFY

Cost
Capital Cost................................ $5.7 M
O&M Cost.......................... $142,500 /yr
Unit Cost...............................$1,650 /AF

Potential Partners
EBMUD

12.0.2 Potential Partners and Supply Amounts

This concept involves a partnership between EBMUD, City of Pinole, and City of Hercules. Both of the wastewater treatment plants in Pinole and Hercules are operated independently, but are within the water supply service area of EBMUD, therefore making EBMUD an important partner in this concept. This project would help conserve EBMUD's high quality water for drinking water supplies. Table E3-33 provides a summary of the potential partners and long-term supply amounts.

Table E3-33
Potential Partner and Supply Amounts

Partner	*Type of Benefit*	*Potential Amount (AFY)*	*Notes/Issues*
EBMUD	Dry-year supply reliability	336 AFY	Would potentially free up potable water.

Dry-Year Supply

The total available dry-year supply for the concept is 336 AFY (EBMUD, 2004).

Average Year Water Quality

There is no water quality benefit associated with this concept.

Other Potential Partners Considered but Not Included

No other potential partners were considered for this concept.

12.0.3 Operating Description

The Pinole and Hercules treatment plants would be upgraded to produce recycled water for distribution to local industrial and irrigation customers that currently use potable water purchased from EBMUD.

12.1 Project Facilities

Table E3-34 summarizes the proposed facilities for this concept (EBMUD, 2004).

Table E3-34
Project Facilities for Franklin Canyon Recycled Water Concept

Facility	*Notes*
Recycled Water facilities • Tertiary treatment facility	Requires upgrades to recycled water facility in Hercules to meet tertiary RW standards.
Wastewater Export Pipeline • New pipelines	Requires constructing export pipeline from Pinole to Hercules.
Pumping Station • New pump station	Pump station required to pump wastewater from Pinole to Hercules.
Pipelines • Distribution pipelines	It is assumed that pipeline alignments will follow public rights-of-way

12.2 Project Costs

Table E3-35 summarizes project capital, operating and annualized costs.

Table E3-35
Estimated Project Costs

Capital Costs	
Environmental Mitigation	-
Total Capital Cost	$ 5.7 M
Operating Costs	
Total Annual Operating Cost	$ 525,000
Annual Costs	
Annualized Capital Costs	$414,100
Operating Costs	$ 142,500
Total Annual Cost	$ 556,600

Basis for Cost Estimates

- Capital Costs: Capital costs associated with this project are $5.7 Million and were confirmed by EBMUD (EBMUD, 2004).

- Environmental Mitigation: Mitigation costs would be limited to the cost of environmental documentation, measures to reduce environmental impacts, and acquisition of permits, if any, and may range from one to two percent of the total capital costs of individual concept development. Environmental mitigation has not been included as a separate line item.

- Operating Costs: Operating costs are based on information from other recycled water projects in the Bay Area that mainly involve expansions of pipelines and reservoirs operating costs were conservatively assumed to be 2.5% of capital costs.

- Annual Costs: Lifecycle costing based on 30-year life project at 6% interest.

12.3 Outstanding Issues and Questions

- Current O&M cost estimates were based on averages from other similar recycled water projects in the Bay Area. These costs need to be confirmed when estimates are available.

13. Lamorinda Phase 1 Recycled Water Project (1,120AFY)

13.0 Concept Overview

13.0.1 Description

This project would supply approximately 1 mgd (1,120 AFY) of recycled water to customers in areas of Walnut Creek, Pleasant Hill, Lafayette, Moraga and Orinda for landscape irrigation. The recycled water would be produced at CCCSD's Recycled Water Plant and distributed to golf courses, schools, parks, cemeteries, etc.

This project would help conserve EBMUD's high quality water for potable uses. The project is currently on hold until outside funding is obtained.

Lamorinda Phase 1 Recycled Water Project

Yield
Supply Yield.................Up to 1,120 AFY
Quality Yield ....0 AFY

Cost
Capital Cost................................. $28 M
O&M Cost........................... $700,000/yr
Unit Cost................................$2,440 /AF

Potential Partners
CCCSD, EBMUD

13.0.2 Potential Partners and Supply Amounts

This concept involves a partnership between EBMUD and CCCSD. Table E3-36 provides a summary of the potential partners and long-term supply amounts.

Table E3-36
Potential Partner and Supply Amounts

Partner	*Type of Benefit*	*Potential Amount (AFY)*	*Notes/Issues*
CCCSD			
EBMUD	Dry-year supply reliability	Up to 1,120 AFY	

Dry-Year Supply

The total available dry-year supply for the concept is 1,120 AFY (EBMUD, 2004).

Average Year Water Quality

There is no water quality benefit associated with this concept.

Other Potential Partners Considered but Not Included

No other potential partners were considered for this concept.

13.0.3 Operating Description

Recycled water would be produced at CCCSD's Recycled Water Plant and distributed to customers in areas of Walnut Creek, Pleasant Hill, Lafayette, Moraga and Orinda for landscape irrigation

13.1 Project Facilities

Table E3-37 summarizes the proposed facilities for this concept (EBMUD, 2004).

Table E3-37
Project Facilities for Lamorinda Phase 1 Recycled Water Concept

Facility	*Notes*
CCCSD Recycled Water Plant • No new facilities	CCCSD's plant has existing capacity to accommodate this project
Pipelines • New pipelines	It is assumed that pipeline alignments will follow public rights-of-way

Basis for Facility Sizing

The existing plant already has capacity to provide another 1 mgd of recycled water for irrigation (Coe, 2000).

13.2 Project Costs

Table E3-38 summarizes project capital, operating and annualized costs.

Table E3-38
Estimated Project Costs

Capital Costs	
Distribution Piping	$ 28 M
Environmental Mitigation	$ ---
Total Capital Cost	$ 28 M
Operating Costs	
Total Annual Operating Cost	$ 0.7 M
Annual Costs	
Annualized Capital Costs	$ $2 M
Operating Costs	$ 0.7 M
Total Annual Cost	$ 2.7 M

Basis for Cost Estimates

- Capital Costs: Capital costs associated with this project are $28 Million. These costs were confirmed by EBMUD (April, 2004).

- Environmental Mitigation: Mitigation costs would be limited to the cost of environmental documentation, measures to reduce environmental impacts, and acquisition of permits, if any, and may range from one to two percent of the total capital costs of individual concept development. Mitigation costs are assumed to be included in the capital cost estimate.

- Operating Costs: Operating costs associated with this project were assumed to be 2.5% of capital costs ($700,000).

- Annual Costs: Lifecycle costing based on 30-year life project at 6% interest.

13.3 Outstanding Issues and Questions

- None.

14. Livermore Agricultural Irrigation Recycled Water Project (2,660 AFY)

14.0 Concept Overview

14.0.1 Description

The Livermore Wastewater Reclamation Plant (LWRP) has been providing recycled water to a local golf course, the airport and other irrigation sites for the last 25-30 years. This concept would expand upon existing recycled water customers by providing 2,660 AFY of recycled water to vineyards in the Livermore area (Brown and Caldwell, 2003).

Livermore Recycled Water Project

Yield
Supply Yield.................. up to 2,660 AFY
Quality Yield ....0 AFY

Cost
Capital Cost.................................. $91 M
O&M Cost................................... $2.5 M
Unit Cost..................................$3400 /AF

Potential Partners
Livermore (Zone 7)

Using recycled water to irrigate vineyards would help to improve dry year supply reliability and would also help to address wastewater disposal constraints. Livermore currently disposes of its wastewater in the Livermore Amador Valley Wastewater Management Agency (LAVWMA) Pipeline, and is restricted to 8.7 MGD of capacity.

14.0.2 Potential Partners and Supply Amounts

This concept involves a partnership between Livermore and Zone 7. By using recycled water instead of potable water supplies for irrigation, this project could help conserve Zone 7's drinking water supplies. Table E3-39 provides a summary of the potential partners and long-term supply amounts.

Table E3-39
Potential Partner and Supply Amounts

Partner	*Type of Benefit*	*Potential Amount (AFY)*	*Notes/Issues*
Livermore (Zone 7)	Dry-year supply reliability	Up to 2,660	Could potentially reduce Livermore's Zone 7 purchases, providing dry-year supply reliability.

Dry-Year Supply

The total available dry-year supply for the concept is 2,660 AFY (Brown and Caldwell, 2003).

Average Year Water Quality

There is no water quality benefit associated with this concept.

Other Potential Partners Considered but Not Included

No other potential partners were considered for this concept.

14.0.3 Operating Description

Recycled water would be produced at the LWRP and distributed to vineyard irrigation customers located south of I-580. Vineyard growers require water of higher quality than typical urban irrigation, so additional treatment will be needed to remove nutrients, minerals and salts.

14.1 Project Facilities

Table E3-40 summarizes the proposed facilities for this concept (Brown & Caldwell, 2003).

Table E3-40
Project Facilities for the Livermore Recycled Water Project

Facility	*Notes*
LWRP • Increase RO Capacity by 1.42 MGD • Blend with existing recycled water	
Storage • South side storage required (1,782 AF)	To provide seasonal storage of recycled water
Distribution Piping • Additional piping to new users	

14.2 Project Costs

Table E3-41 summarizes project capital, operating and annualized costs (Greenwood, 2004).

Table E3-41
Estimated Project Costs

Capital Costs	
LWRP upgrades, distribution piping	$ 91 M
Environmental Mitigation	$ --
Total Capital Cost	$ 91 M
Operating Costs	
Total Annual Operating Cost	$ 2.5 M
Annual Costs	
Annualized Capital Costs	$ 6.6 M
Operating Costs	$ 2.5 M
Total Annual Cost	$ 9.1 M

Basis for Cost Estimates

- Capital Costs: Capital costs associated with this project are based on information provided in the *Recycled Water Agriculture Reuse Feasibility Study* (Brown and Caldwell, 2003).

- Environmental Mitigation: Mitigation costs would be limited to the cost of environmental documentation, measures to reduce environmental impacts, and acquisition of permits, if any, and may range from one to two percent of the total capital costs of individual concept development. Environmental mitigation costs are assumed to be included in the capital cost estimates and are not broken out separately.

- Operating Costs: Operating costs associated with this project are based on information provided in the *Recycled Water Agriculture Reuse Feasibility Study* (Brown and Caldwell, 2003).

- Annual Costs: Lifecycle costing based on 30-year life project at 6% interest.

14.3 Outstanding Issues and Questions

- Confirm need for Zone 7 dry-year supply.

15. Livermore Municipal Irrigation Recycled Water Project (2,240 - 2,800 AFY)

15.0 Concept Overview

15.0.1 Description

The Livermore Water Reclamation Plant (LWRP) has been providing recycled water to a local golf course, the airport and other irrigation sites for the last 25-30 years. Current peak summer demand averages 2.5-3 mgd (Greenwood, 2004).

This project would increase the recycled water demand to 5 mgd (representing an increase of up to 2,800 AFY) by expanding the existing irrigation customer base to developments located north of I-580 (Greenwood, 2004).

Livermore Recycled Water Project

Yield
Supply Yield.................. up to 2,800 AFY
Quality Yield ....0 AFY

Cost
Capital Cost................................ $2-3 M
O&M Cost.......................... $0.5-1.2 M/yr
Unit Cost..........................$200-$500 /AF

Potential Partners
Livermore (Zone 7)

15.0.2 Potential Partners and Supply Amounts

This concept would involve a partnership between Livermore and Zone 7. By using recycled water instead of potable water supplies for irrigation, this project would help conserve Zone 7's drinking water supplies. Table E3-42 provides a summary of the potential partners and long-term supply amounts.

Table E3-42
Potential Partner and Supply Amounts

Partner	*Type of Benefit*	*Potential Amount (AFY)*	*Notes/Issues*
Livermore (Zone 7)	Dry-year supply reliability	Up to 2,800	Potential to conserve potable water supplies.

Dry-Year Supply

The total available dry-year supply for the concept is 2,240 – 2,800 AFY, calculated based on EDAW communications with Darren Greenwood, City of Livermore (Greenwood, 2004).

Average Year Water Quality

There is no water quality benefit associated with this concept.

Other Potential Partners Considered but Not Included

No other potential partners were considered for this concept.

15.0.3 Operating Description

Recycled water would be produced at the LWRP and distributed to irrigation customers located north of I-580.

15.1 Project Facilities

Table E3-43 summarizes the proposed facilities for this concept

Table E3-43
Project Facilities for the Livermore Recycled Water Project

Facility	***Notes***
• Wastewater Treatment Plant Upgrades • Distribution Piping	Need to confirm if the WWTP has capacity to expand recycled water production.

15.2 Project Costs

Table E3-44 summarizes project capital, operating and annualized costs (RMC Communications with Darren Greenwood, City of Livermore, February 2004).

Table E3-44
Estimated Project Costs

Capital Costs	
WPCP upgrades, distribution piping	$ 2-3 M
Environmental Mitigation	$ --
Total Capital Cost	$ 2-3 M
Operating Costs	$
Total Annual Operating Cost	$ 0.5 – 1.2 M
Annual Costs	
Annualized Capital Costs	$ 0.1-0.2M
Operating Costs	$ 0.5-1.2M
Total Annual Cost	$ 0.6-1.4M

Basis for Cost Estimates

- Capital Costs: Capital costs associated with this project are based on information provided by Darren Greenwood, City of Livermore, February 2004.
- Environmental Mitigation: Mitigation costs would be limited to the cost of environmental documentation, measures to reduce environmental impacts, and acquisition of permits, if any, and may range from one to two percent of the total capital costs of individual concept development. Environmental mitigation is assumed to be included in the capital cost estimate and is not broken out separately.
- Operating Costs: Operating costs associated with this project are based on information provided by Darren Greenwood, City of Livermore, February 2004.
- Annual Costs: Lifecycle costing based on 30-year life project at 6% interest.

15.3 Outstanding Issues and Questions

- Need to confirm whether or not the LWRP will need to be expanded to accommodate this project.

16. Millbrae Recycled Water Project (1,120 AFY)

16.0 Concept Overview

16.0.1 Description

The City of Millbrae currently provides Caltrans with 0.01 mgd (11 AFY) of recycled water (restricted use) for irrigation along US101. The City has considered expanding the production of recycled water to better utilize this valuable resource. One possibility would involve upgrading the existing Millbrae Wastewater Treatment Plant (WWTP) to produce 1.0 mgd of tertiary treated recycled water for unrestricted use (RMC, 2003). Recycled water would be conveyed from the Millbrae WWTP to customers located in Millbrae and adjacent areas of San Bruno, Burlingame and the San Francisco Airport.

Millbrae Recycled Water Project

Yield
Supply Yield..................up to 1,120 AFY
Quality Yield.................................0 AFY

Cost
Capital Cost ....$14-$16M (RMC Est.)
O&M Cost ....$0.3-$0.4M (RMC Est.)
Unit Cost . $1200 – $1400/AF (RMC Est)

Partners

Cities of Millbrae, San Bruno, Burlingame, (BAWSCA, SFPUC) and the San Francisco Airport (SFPUC).

16.0.2 Potential Partners and Supply Amounts

At this time potential partners for the Millbrae Recycled Water Project are not known but could possibly include the Cities of San Bruno, Burlingame, and the San Francisco Airport. This concept would provide a new source of supply to existing users, potentially allowing dry-year supplies to be used for other uses.

Dry-Year Supply

The total available dry-year supply for the concept is 1 mgd or 1,120 AFY (RMC, 2003). Table E3-45 provides a summary of potential partners and long term supply amounts.

Table E3-45
Potential Partner and Supply Amounts

Partner	***Type of Benefit***	***Potential Amount (AFY)***	***Notes/Issues***
Millbrae (BAWSCA, SFPUC)	Dry-year supply reliability	TBD	Project would potentially conserve current water supplies and potentially increase dry-year supply reliability.
San Bruno (BAWSCA, SFPUC)	Dry-year supply reliability	TBD	Project would potentially conserve current water supplies and potentially increase dry-year supply reliability.
Burlingame (BAWSCA, SFPUC)	Dry-year supply reliability	TBD	Project would potentially conserve current water supplies and potentially increase dry-year supply reliability.
San Francisco Airport (SFPUC	Dry-year supply reliability	TBD	Project would potentially conserve current water supplies and potentially increase dry-year supply reliability.
Total		1,120 AFY	

Average Year Water Quality

There is no water quality benefit associated with this concept.

Other Potential Partners Considered but Not Included

No other potential partners have been considered for this project.

16.0.3 Operating Description

The Millbrae Wastewater Treatment Plant would be upgraded to produce recycled water suitable for unrestricted use. Distribution piping would be constructed to convey the recycled water from the WWTP to customers located in Millbrae and adjacent areas of San Bruno, Burlingame and the San Francisco Airport.

16.1 Project Facilities

Table E3-46 summarizes the proposed facilities for this concept.

Table E3-46
Project Facilities for Millbrae Recycled Water Concept

Facility	*Notes*
Millbrae Wastewater Treatment Plant • Tertiary treatment plant (1 MGD)	Existing plant would be upgraded to produce Title 22 recycled water
Pipelines • Distribution piping	Piping alignments assumed to follow public rights of way.

Basis for Facility Sizing

Preliminary sizing of the WWTP tertiary treatment process capacity (1 mgd) is based on personal communications with Dick York, Millbrae WWTP Superintendent (RMC, 2004).

16.2 Project Costs

Table E3-47 summarizes project capital, operating and annualized costs.

Table E3-47
Estimated Project Costs

Capital Costs	
WWTP Upgrade and Distribution	$ 14-16 M (RMC Estimate)
Environmental Mitigation	$ --
Total Capital Cost	$ $14-16M
Operating Costs	
Total Annual Operating Cost	$ 0.3-0.4M (RMC Estimate)
Annual Costs	
Annualized Capital Costs	$ $14-16M
Operating Costs	$ 0.3-0.4M (RMC Estimate)
Total Annual Cost	$

Basis for Cost Estimates

- Capital Costs: WWTP Upgrades and Distribution Facilities: Capital costs associated with the WWTP upgrades were based on the calculated per acre foot average from six similar projects identified in the concept elements ($1200-$1400/AF). The total capital cost was then calculated by RMC by multiplying the unit cost by the yield of 1,120 AFY.

- Environmental Mitigation: Mitigation costs would be limited to the cost of environmental documentation, measures to reduce environmental impacts, and acquisition of permits, if any, and may range from one to two percent of the total capital costs of individual concept development. Costs are assumed to be included in the general capital cost estimate and are not broken out separately.

- Operating Costs: Operating costs were assumed to be 10% of capital costs.

- Annual Costs: Lifecycle costing based on 30-year life project at 6% interest.

16.3 Outstanding Issues and Questions

- Cost estimates are based on averages of similar Bay Area water recycling concepts. Need to be verified with project participants.

- Confirm project participants

17. NCCWD/Pacifica Recycled Water Project (225 AFY)

17.0 Concept Overview

17.0.1 Description

The City of Pacifica is currently producing 3.4 mgd of tertiary treated wastewater that is being used for wetlands restoration at its Calera Creek Water Recycling Plant. The North Coast County Water District (NCCWD), in a partnership with the San Francisco Public Utilities Commission (SFPUC) has developed a program to make recycled water available to the San Francisco owned Golf Course in Pacifica, the Sharp Park Golf Course, and also extending the offer of recycled water to the Jefferson Unified School District, the City of Pacifica and Cal Trans for Highway 1 irrigational uses, and other potential irrigation customers (RMC, 2003, Kennedy/Jenks, 2001, BAWSCA, 2004).

NCCWD/Pacifica Recycled Water Project

Yield
Supply Yield.................... up to 225 AFY
Quality Yield ....0 AFY

Cost
Capital Cost.......................... $4.0 Million
O&M Cost.............................. $30,000/yr
Unit Cost................................$1,400/AF

Potential Partners
NCCWD, BAWSCA, SFPUC

17.0.2 Potential Partners and Supply Amounts

This concept involves a partnership between NCCWD, Pacifica, and SFPUC This concept would provide a new source of supply to existing water users, potentially freeing up dry-year supply for other uses.

Dry-Year Supply

The total available dry-year supply for the concept is approximately 225 AFY (Kennedy/Jenk, 2004). Table E3-48 provides a summary of potential partners and long-term supply amounts.

Table E3-48
Potential Partner and Supply Amounts

Partner	*Type of Benefit*	*Potential Amount (AFY)*	*Notes/Issues*
NCCWD (BAWSCA, SFPUC)	Dry-year supply reliability	225	225 AF is the expected peak annual usage during a dry year.
Total		225 AFY	

Average Year Water Quality

There is no water quality benefit associated with this concept.

17.0.3 Operating Description

The recycled water production capacity at the Calera Creek Water Recycling Plant remains the same at 3.3 mgd; however, up to 225 AF/yr. would be diverted from the Calera Creek fresh water marsh to irrigation of the Sharp Park golf course, city parks, playing fields at schools and Cal Trans Highway 1 landscaping.

17.1 Project Facilities

Table E3-49 summarizes the proposed facilities for this concept (Kennedy/Jenks, 2001).

Table E3-49
Project Facilities for Pacifica Recycled Water Concept

Facility	***Notes***
Calera Creek Water Recycling Treatment and Recycling Plant • 3.3 mgd tertiary treatment plant • New supply pumps in the Cascade Aerator structure	
Recycled Water Storage Tank • 400,000 gallon recycled water storage tank	To be located on San Francisco property above Sharp Park Golf Course
Pipelines • Transmission line from Treatment Plant to Storage Tank • Distribution Piping	Piping would be installed and operated by the North Coast County Water District, while the Calera Creek WRP would be responsible for supplying the Water District with tertiary treated water.

17.2 Project Costs

Table E3-50 summarizes project capital, operating and annualized costs (Kennedy/Jenks, 2001). These are conceptual level costs developed by Kennedy/Jenks as part of the 1997 *Conceptual Water Reclamation Plan* for Pacifica. Updated costs are currently being developed and should be available in 2004.

Table E3-50
Estimated Project Costs

Capital Costs	
WWTP Upgrade and Distribution	$ 4,000,000
Environmental Mitigation	$ --unknown
Total Capital Cost	$ 4,000,000
Operating Costs	
Total Annual Operating Cost	$ 30,000
Annual Costs	
Annualized Capital Costs	$ 290,000
Operating Costs	$ 30,000
Total Annual Cost	$ 320,000

Basis for Cost Estimates

- Capital Costs: WWTP Upgrades and Distribution Facilities: Capital costs associated with this project were developed by Kennedy/Jenks consultants as part of the 1997 *Conceptual Water Reclamation Plan* for Pacifica. Project costs have been updated to include further planning and project refinements, since 1997, and have been escalated to 2003 dollars.

- Environmental Mitigation: Mitigation costs would be limited to the cost of environmental documentation, measures to reduce environmental impacts, and acquisition of permits, if any, and may range from one to two percent of the total capital costs of individual concept development. Environmental mitigation costs are assumed to be included in the capital cost estimate and are not broken out as a separate line item.

- Operating Costs: Operating costs associated with this project were developed by Kennedy/Jenks consultants as part of the 1997 *Conceptual Water Reclamation Plan* for Pacifica. Since then, further planning and refinement has occurred and project costs have been updated and escalated to 2003 dollars.

- Annual Costs: Lifecycle costing based on 30-year life project at 6% interest.

17.3 Outstanding Issues and Questions

- Conceptual level cost estimates need to be revised once Kennedy /Jenks completes the project Facility Planning Report (scheduled for December 2204).

18. North Richmond – Recycled Water Expansion Project (4,480 AFY)

18.0 Concept Overview

18.0.1 Description

The West County Wastewater District (WCWD) currently provides secondary treated wastewater effluent to the North Richmond Water Reclamation Plant (NRWRP), owned by EBMUD, for tertiary treatment. This plant currently produces 3.0 mgd of recycled water for use in three cooling towers at ChevronTexaco's Richmond Oil Refinery. This project involves the production of an additional 4 mgd of recycled water. Existing treatment facilities would be used to serve 1 mgd to a fourth cooling tower at the Chevron Texaco refinery and irrigation customers. The project would also involve the construction of additional advanced treatment facilities to serve 3 mgd to ChevronTexaco for boiler feed water. [*] The project has not begun and is contingent upon obtaining outside funding.

N. Richmond Expansion Recycled Water Project

Yield
Supply Yield.................. up to 4,480AFY
Quality Yield ....0 AFY

Cost
Capital Cost................................. $50 M
O&M Cost.............................. $1.25 M/yr
Unit Cost............................ $ 1090 /AFY

Potential Partners
EBMUD, West County Wastewater District

18.0.2 Potential Partners and Supply Amounts

This concept involves a partnership between EBMUD and WCWD. Using recycled water for industrial uses will help to conserve high quality drinking water supplies. Table E3-51 provides a summary of the potential partners and long-term supply amounts.

Table E3-51
Potential Partner and Supply Amounts

Partner	*Type of Benefit*	*Potential Amount (AFY)*	*Notes/Issues*
EBMUD	Dry-year supply reliability	4,480 AFY	Recycled water supply to Chevron Texaco Refinery and irrigation customers in the area (assumes Chevron Texaco has ability to take additional recycled water supplies)

Dry-Year Supply

The total available dry-year supply for the concept is 4,480 AFY (EBMUD, 2004).

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[*] This project is known as the Richmond Advanced Recycled Expansion Water Project (RARE Water Project)

Average Year Water Quality

There is no water quality benefit associated with this concept.

Other Potential Partners Considered but Not Included

No other potential partners were considered for this concept.

18.0.3 Operating Description

Recycled water would be produced at a recycled water facility located at the existing NRWRP. NRWRP is sized for 5.4 mgd and is currently providing 3.0 mgd (EBMUD 2004). Expansion of NRWRP is not necessary in order to serve the fourth cooling tower and irrigation customers. Additional treatment facilities (microfiltration and reverse osmosis) would be required to serve the ChevronTexaco refinery with boiler feedwater.

18.1 Project Facilities

Table E3-52 summarizes the proposed facilities for this concept (EBMUD, 2004).

Table E3-52
Project Facilities for N Richmond – Chevron Recycled Water Concept

Facility	*Notes*
NRWRP • Additional treatment facilities, including MF/RO would be required to serve 3 mgd for boiler feedwater.	The NRWRP has excess capacity to accommodate an additional 1 mgd for the fourth cooling tower and irrigation customers.
Pipelines • Additional pipelines needed to convey water to fourth cooling tower, irrigation customers and boiler feed.	

18.2 Project Costs

Table E3-53 summarizes project capital, operating and annualized costs.

Table E3-53
Estimated Project Costs

Capital Costs	
Distribution Piping	$ 50 M
Environmental Mitigation	$ ---
Total Capital Cost	$ 50 M
Operating Costs	
Total Annual Operating Cost	$ 1.25 M
Annual Costs	
Annualized Capital Costs	$ 3.63M
Operating Costs	$ 1.25 M
Total Annual Cost	$ 4.88 M

Basis for Cost Estimates

- Capital Costs: Capital costs associated with this project are $50 million as estimated in the Urban Water Management Plan (EBMUD, 2002) and confirmed by EBMUD (EBMUD, 2004).

- Environmental Mitigation: Mitigation costs would be limited to the cost of environmental documentation, measures to reduce environmental impacts, and acquisition of permits, if any, and may range from one to two percent of the total capital costs of individual concept development. Environmental mitigation costs are assumed to be included in the EBMUD cost estimate and have not been identified separately.

- Operating Costs: Operating costs are based on information from other recycled water projects in the Bay Area that mainly involve expansions of pipelines and reservoirs operating costs were conservatively assumed to be 2.5% of capital costs. These costs need to be confirmed when estimates are available.

- Annual Costs: Lifecycle costing based on 30-year life project at 6% interest.

18.3 Outstanding Issues and Questions

- Need to confirm whether or not existing distribution facilities have capacity to provide an additional 1 mgd to the fourth cooling tower and irrigation customers.

- Need to confirm the feasibility of provided recycled water for boiler feedwater.

19. Palo Alto – Recycled Water Project (1,830-4,677 AFY)

19.0 Concept Overview

19.0.1 Description

The Palo Alto recycled water concept would entail the production of 1,830-4,677 AFY of recycled water at the Palo Alto Regional Water Quality Control Plant (RWQCP) for distribution within the local service area for irrigation and commercial/industrial uses.

Palo Alto – Other Recycled Water Project

Yield
Supply Yield........ up to 1,830-4,677 AFY
Quality Yield ....0 AFY

Cost
Capital Cost...................... $16 M -$41 M
O&M Cost................. $0.4 M – $1.2 M/yr
Unit Cost................................. $860/AFY

Potential Partners
Palo Alto, East Palo Alto, Stanford University , Mountain View, Los Altos/Los Altos Hills, BAWSCA, SFPUC.

19.0.2 Potential Partners and Supply Amounts

Potential partners for this project include the City of Palo Alto, East Palo Alto, Mountain View, Los Altos/Los Altos Hills, BAWSCA, SCVWD, and SFPUC. Table E3-54 provides a summary of the potential partners and long-term supply amounts.

Table E3-54
Potential Partner and Supply Amounts

Partner	*Type of Benefit*	*Potential Amount (AFY)*	*Notes/Issues*
Palo Alto and East Palo Alto	Dry-year supply reliability	1,203-2,401	Could offset use of SFPUC supply if existing users served.
Stanford University	Dry-year supply reliability	Up to 706	Yield calculated as total RW potential for Stanford (1,800 AF) minus local Stanford supply projects (1,094 AF) [Refer to Section 22]. Yield could be as high as 1,800 AF if local Stanford RW projects are found to be less cost-effective than Palo Alto RWQCP supply. Could offset use of SFPUC supply if existing users served.
Mountain View	Dry-year supply reliability	220-490	Could offset use of SCVWD or SFPUC supply if existing users served.
Los Altos/Los Altos Hills	Dry-year supply reliability	407-1,080	Could offset use of SCVWD or SFPUC supply if existing users served.
Total		1,830-4,677 AFY	

Dry-Year Supply

The total available dry-year supply for the concept is 1,830 - 4,677 AFY. The potential recycled yield for Stanford (706 AF) was calculated assuming local Stanford supply projects (i.e., non Palo Alto RWQCP supplies) would account for 1,094 AFY of Stanford's total recycled water potential for the 2030 planning horizon (1,800 AFY), as confirmed by Marty Laporte (Stanford Utilities) on June 1, 2004. The other Palo Alto RWQCP recycled water demands were based on information provided in the *Mt.View/Moffett Field Area Water Reuse Project Regional Recycled Facilities Planning Study (RMC, 2004).*

Average Year Water Quality

There is no water quality benefit associated with this concept.

Other Potential Partners Considered but Not Included

No other potential partners have been identified at this time.

19.0.3 Operating Description

The sizing and cost of new facilities at Palo Alto Regional Water Quality Control Plant will depend on the total recycled water demand for this concept and the Mountain View/Moffett Field Recycled Water Project. The plant has capacity to meet 4.0 mgd of recycled water demand. Currently 1.5 mgd of recycled water is being produced mostly for golf course and park irrigation use. Facility and distribution network costs will be developed, as needed, once the total recycled water demand for all Palo Alto projects is decided upon.

19.1 Project Facilities

Table E3-55 summarizes the proposed facilities for this concept.

Table E3-55
Project Facilities for Palo Alto –Recycled Water Concept

Facility	*Notes*
Palo Alto Water Quality Control Plant • None	The treatment plant can be easily upgraded to produce a total of 8.0 mgd of recycled water. More extensive upgrades will be required if the total recycled water production exceeds 8.0 mgd.
Pipelines • Distribution piping	Piping alignments assumed to follow public rights of way.

Basis for Facility Sizing

The sizing of new facilities at the Palo Alto Water Quality Control Plant will depend on the total recycled water demand for all Palo Alto projects. The plant currently has capacity to meet 4.0 mgd of recycled water demand, and can be upgraded to 8.0 mgd within the RWQCP property.

19.2 Project Costs

Table E3-56 summarizes project capital, operating and annualized costs.

Table E3-56
Estimated Project Costs

Capital Costs	
Distribution	
Environmental Mitigation	
Total Capital Cost	$16 M - $41 M
Operating Costs	
Total Annual Operating Cost	$0.4 M – 1.0 M
Annual Costs	
Annualized Capital Costs	$ 1.2 M - $3.0 M
Operating Costs	$ 0.4 M - $1.0 M
Total Annual Cost	$ 1.6 M - $4.0 M

Basis for Cost Estimates

- Capital Costs: Capital costs were estimated assuming a similar capital unit cost for the Palo Alto Mountain View Concept ($8,760/AFY). This unit cost was calculated by dividing the capital cost for the Palo Alto Mountain View Concept ($16.3 M) by the upper yield limit for the concept (1,860 AFY).

- Environmental Mitigation: Mitigation costs would be limited to the cost of environmental documentation, measures to reduce environmental impacts, and acquisition of permits, if any, and may range from one to two percent of the total capital costs of individual concept development. These costs are assumed to be included in capital cost estimates and are not broken out separately.

- Operating Costs: Based on information from other recycled water projects in the Bay Area that mainly involve expansions of pipelines and reservoirs operating costs were conservatively assumed to be 2.5% of capital costs.

- Annual Costs: Lifecycle costing based on 30-year life project at 6% interest.

19.3 Outstanding Issues and Questions

- Need to confirm project partners.

20. Palo Alto RWQCP – Mountain View Recycled Water Project (1,480 – 1,860 AFY)

20.0 Concept Overview

20.0.1 Description

The Palo Alto RWQCP– Mountain View recycled water project would entail the production of recycled water at the Palo Alto Regional Water Quality Control Plant (RWQCP) for distribution to portions of Palo Alto, the Mountain View Shoreline Area[1] and Moffett Field for irrigation and industrial usage.

This concept would provide a new source of supply to existing users, potentially allowing dry-year supplies to be used for other uses. Existing supplies include high quality SFPUC supplies, groundwater and SCVWD supply. This project would reduce wastewater discharge to the South Bay.

Palo Alto RWQCP – Mountain View Recycled Water Project

Yield
Supply Yield..... up to 1,480 – 1,860 AFY
Quality Yield ....0 AFY

Cost
Capital Cost.............................. $16.3 M
O&M Cost........................... $300,000 /yr
Unit Cost..........................$810-1015 /AF

Partners
Palo Alto, Mountain View, Moffett Field
BAWSCA, SFPUC

20.0.2 Potential Partners and Supply Amounts

Potential partners for this project include the City of Palo Alto, the City of Mountain View, and Moffett Field, BAWSCA, SCVWD and SFPUC. Table E3-57 provides a summary of the potential partners and long-term supply amounts (RMC, 2004).

Table E3-57
Potential Partner and Supply Amounts

Partner	*Type of Benefit*	*Potential Amount (AFY)*	*Notes/Issues*
Palo Alto	Dry-year supply reliability	70-80 AFY	
Mountain View	Dry-year supply reliability	1,300-1,520 AFY	
Moffett Field	Dry-year supply reliability	110-260 AFY	This extension is contingent on funding and a use commitment from NASA/Ames.
Total		1,480-1,860 AFY	

Dry-Year Supply

The total available dry-year supply for the concept is 1,480 – 1,860 AFY (RMC, 2004).

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[1] The Mountain View Shoreline area includes the land north of U.S. 101.

Average Year Water Quality

There is no water quality benefit associated with this concept.

20.0.3 Operating Description

Recycled water would be produced at the Palo Alto RWQCP and would be pumped to a hydraulic head of 350 ft and distributed to the City of Palo Alto, the Mountain View Shoreline area and Moffett Field area (RMC, 2004). This would require upgrades to the existing plant, which currently has capacity to produce 4.0 mgd of recycled water (RMC, 2004). Upgrades would include a retrofit of tanks to provide operational storage and replacement of the existing RW pump station.

20.1 Project Facilities

Table E3-58 summarizes the proposed facilities for this concept.

Table E3-58
Project Facilities for Palo Alto – Mt View Recycled Water Concept

Facility	*Notes*
Palo Alto Regional Water Quality Control Plant • Expanded RW Treatment Facilities	The treatment plant can be easily upgraded to produce 8.0 mgd of recycled water. More extensive upgrades will be required if the total recycled water production exceeds this amount.
Pipelines • Distribution piping	The project will replace an existing deteriorating pipeline to Shoreline Golf Course and to extend the pipeline to the Mountain View-Moffett Field area. Piping alignments will follow the levees near Palo Alto Refuse Center, along Matadero Creek and will be located adjacent to East Bayshore towards Mountain View (City of Palo Alto, 2004).

Basis for Facility Sizing

The sizing and cost of new facilities at the Palo Alto Regional Water Quality Control Plant will depend on the total recycled water demand for all Palo Alto projects. The plant currently has capacity to meet 4.0 mgd of recycled water demand. The cost included in this report refers only to the distribution network for the Palo Alto-Mountain View project. Facility costs (if demand exceeds 4.0 mgd) would be developed once the total recycled water demand for all Palo Alto Projects is decided upon.

20.2 Project Costs

Table E3-59 summarizes the estimated project capital, operating and annualized costs (RMC, 2004).

Table E3-59
Estimated Project Costs

Capital Costs	
Distribution	$16.3 M
Environmental Mitigation	$--
Total Capital Cost	$16.3 M
Operating Costs	
Total Annual Operating Cost	$ 300,000
Annual Costs	
Annualized Capital Costs	$1,200,000
Operating Costs	$ 300,000
Total Annual Cost	$1,500,000

Basis for Cost Estimates

- Capital Costs: Capital costs associated with this project are based on the *Mountain View/Moffett Field Area Water Reuse Project - Regional Recycling Facilities Planning Study* (RMC, 2004).

- Environmental Mitigation: Mitigation costs would be limited to the cost of environmental documentation, measures to reduce environmental impacts, and acquisition of permits, if any, and may range from one to two percent of the total capital costs of individual concept development. Environmental mitigation costs are assumed to be included in the capital cost estimate and are not listed separately.

- Operating Costs: Operating costs associated with this project are based on the *Mountain View/Moffett Field Area Water Reuse Project - Regional Recycling Facilities Planning Study* (RMC, 2004).

- Annual Costs: Lifecycle costing based on 20-year life project at 4% interest.[2]

20.3 Outstanding Issues and Questions

None.

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[2] Note this differs from the other annual cost estimates that were made using a 30-year life project at 6% interest.

21. Redwood City Recycled Water Project (1,960 AFY)

21.0 Concept Overview

21.0.1 Description

This concept would involve the production up to 1,960 AFY of recycled water at the South Bayside System Authority (SBSA) Wastewater Treatment Plant, for distribution to customers in Redwood Shores, the greater Bayfront area and Central Redwood City areas of Redwood City for irrigation, industrial and other non-potable uses. There is also potential to expand the project to serve adjacent communities (Kennedy/Jenks, 2002).

In 2000, Redwood City was consuming approximately 1,000 AFY over its assured SFPUC supply (12,243 AFY). This project will help to reduce potable water demands to levels within the current SFPUC supply assurance (Kennedy/Jenks, 2002).

SBSA/Redwood City Recycled Water Project

Yield
Supply Yield.................. up to 1,960 AFY
Quality Yield ....0 AFY

Cost
Capital Cost......................... $72 - $84 M
O&M Cost................................$0.4 M/Yr
Unit Cost.................$ 2,900 - $3,300 /AF

Potential Partners
San Carlos, Belmont, Redwood City (SFPUC, BAWSCA)

21.0.2 Potential Partners and Supply Amounts

Potential partners in the project include the cities and water suppliers in Redwood City, San Carlos, and Belmont and potentially BAWSCA and SFPUC. Table E3-60 provides a summary of the potential partners and long-term supply amounts (Kennedy/Jenks, 2002).

Table E3-60
Potential Partner and Supply Amounts

Partner	***Type of Benefit***	***Potential Amount (AFY)***	***Notes/Issues***
Redwood City	Dry-year supply reliability	1,960	
San Carlos & Belmont	Dry-year supply reliability	300-800	Terminal storage and pumping to be provided by partners
Total		1,960 AFY	

Dry-Year Supply

The maximum available dry-year supply for the approved project per the Certified Mitigated Negative Declaration is 1,960 AFY (Kennedy/Jenks, 2002).

Average Year Water Quality

As part of a regional project and/or within Redwood City, there could be water quality benefits associated with this project.

Other Potential Partners Considered but Not Included

The 1999 BARWRP Master Plan was considered for this project.

21.0.3 Operating Description

Recycled water would be produced at the SBSA plant for distribution to customers within Redwood City. All storage would be located at SBSA plant. Pumping is provided at the SBSA plant.

Unused daytime capacity in transmission facilities could be used to provide service to adjacent communities. These cities would require remote storage and pumping.

21.1 Project Facilities

Table E3-61 summarizes the proposed facilities for this concept.

Table E3-61
Project Facilities for SBSA/Redwood City Recycled Water Concept

Facility	***Notes***
SBSA Treatment Plant (to be owned and operated by SBSA) • SBSA Plant Upgrades for production of Title 22 tertiary recycled water	A centralized recycled water production facility will be located at the SBSA site therefore eliminating the need to find new sites and minimizing environmental impacts. Most of the treatment facilities needed for recycled water already exist at the SBSA and only require modifications.
Pumping and Storage (to be owned and operated by Redwood City) • SBSA Pumping Station • SBSA Storage	SBSA has room for on-site storage Remote pumping and/or storage would be required for addition of adjacent communities.
Pipelines (to be owned and operated by Redwood City) • Transmission line and distribution piping	Piping alignments to follow public rights of way.

Basis for Facility Sizing

Preliminary sizing of the SBSA plant and distribution facilities is based on the maximum demand identified in the market assessment completed by Kennedy/Jenks as part of the *Water Recycling Feasibility Study for Redwood City*.

21.2 Project Costs

Table E3-62 summarizes project capital, operating and annualized costs.

Table E3-62
Estimated Project Costs

Capital Costs	
WWTP Upgrade and Distribution	$ 72 - $84 M
Environmental Mitigation	$ --
Total Capital Cost	$ 72 - $84 M
Operating Costs	
Total Annual Operating Cost	$ 0.4 M
Annual Costs	
Annualized Capital Costs	$ 5.2 - $6.1M
Operating Costs	$ 0.4M
Total Annual Cost	$ 5.6 - $6.5M

Basis for Cost Estimates

- Capital Costs: Capital costs for this project are based on information from Peter Ingram, Public Works Services Director for Redwood City.

- Environmental Mitigation: Mitigation costs would be limited to the cost of environmental documentation, measures to reduce environmental impacts, and acquisition of permits, if any, and may range from one to two percent of the total capital costs of individual concept development. Environmental mitigation costs are assumed to be included in the capital cost estimate and are not broken out separately.

- Operating Costs: Based on information from other recycled water projects in the Bay Area that mainly involve expansions of pipelines and reservoirs operating costs were conservatively assumed to be 2.5% of capital costs.

- Annual Costs: Lifecycle costing based on 30-year life project at 6% interest.

21.3 Outstanding Issues and Questions

- Project would be phased in over 10-16 years.

22. SF Recycled Water Project (up to 19,000 AFY)

22.0 Concept Overview

22.0.1 Description

The City and County of San Francisco is currently preparing a Recycled Water Master Plan Update to provide guidance for the implementation of recycled water projects in the City. The development of recycled water will help San Francisco meet its long-term water supply needs while increasing its overall water supply reliability.

SF Recycled Water Project

Yield
Supply Yield................ up to 19,000 AFY
Quality Yield ....0 AFY

Cost
Capital Cost.................................. $TBD
O&M Cost..................................... $TBD
Unit Cost....................................... $TBD

Potential Partners
SPFUC

The Recycled Water Master Plan Update builds upon recycled water plans and studies conducted in the City in the 1990s. It will consider new technologies as well as potential new markets for recycled water. The draft Plan is scheduled to be completed in the summer of 2005. The final Plan including the CEQA review process will be completed in 2006, so that construction of recycled water projects can begin.

22.0.2 Potential Partners and Supply Amounts

Table E3-63 provides a summary of the potential partners and long-term supply amounts.

Table E3-63
Potential Partner and Supply Amounts

Partner	*Type of Benefit*	*Potential Amount (AFY)*	*Notes/Issues*
SFPUC	Dry-year supply reliability	Up to 19,000	May make water available to other SFPUC retail or wholesale customers

Dry-Year Supply

The average annual recycled water demand associated with all the potential recycled water uses/users identified as of October 2004 is estimated at 17 million gallons per day (approximately 19,000 AFY) in 2030. This demand estimate will be subject to some variations throughout the master plan process (RMC, 2004). It is anticipated that there will be various project implementation phases and the SFPUC is in the process of determining what portion of the 2030 potential recycled water uses should be targeted for service and when. Revised estimates will be included in the final Recycled Water Master Plan Update that will be completed in 2006.

Average Year Water Quality

There is no water quality benefit associated with this concept.

Other Potential Partners Considered but Not Included

No other potential partners were considered for this concept.

22.0.3 Operating Description

Operating aspects of recycled water will be developed as part of ongoing studies by the SFPUC.

22.1 Project Facilities

Project facilities will be developed as part of ongoing studies by the SFPUC.

22.2 Project Costs

Project facilities will be developed as part of ongoing studies by the SFPUC.

22.3 Outstanding Issues and Questions

- Project facilities, and costs have yet to be determined, but will be included in the final Recycled Water Master Plan Update.

23. San Leandro Recycled Water Project (1,060 AFY)

23.0 Concept Overview

23.0.1 Description

The San Leandro Reclamation (SLR) Facility currently supplies more than 0.5 mgd of secondary-treated recycled water for irrigation of two golf courses and the Harbor Bay Parkway. Current proposals aim to expand the production of recycled water by upgrading the SLR to provide existing customers with tertiary-treated water and an additional 0.5 mgd (560 AFY) of tertiary-treated water to potential irrigation, industrial and commercial customers (EBMUD, 2004).

San Leandro Recycled Water Project

Yield
Supply Yield........................... 1,060 AFY
Quality Yield ....0 AFY

Cost
Capital Cost.................................. $19 M
O&M Cost................................$475K /yr
Unit Cost.................................$1,750/AF

Potential Partners
San Leandro (EBMUD)

This project would help conserve EBMUD's high quality water for drinking water supplies.

23.0.2 Potential Partners and Supply Amounts

Table E3-64 provides a summary of the potential partners and long-term supply amounts.

Table E3-64
Potential Partner and Supply Amounts

Partner	*Type of Benefit*	*Potential Amount (AFY)*	*Notes/Issues*
San Leandro (EBMUD)	Dry-year supply reliability	1,060 AFY	

Dry-Year Supply

The total available dry-year supply for the concept is 1,060 AFY (EBMUD, 2004).

Average Year Water Quality

There is no water quality benefit associated with this concept.

Other Potential Partners Considered but Not Included

No other potential partners were considered for this concept.

23.0.3 Operating Description

The San Leandro Reclamation Facility would be upgraded to produce 1.0 mgd of tertiary treated recycled water for distribution to potential irrigation, industrial and commercial customers.

23.1 Project Facilities

Table E3-65 summarizes the proposed facilities for this concept (EBMUD, 2004).

Table E3-65
Project Facilities for San Leandro Recycled Water Concept

Facility	***Notes***
San Leandro Reclamation Facility • New Tertiary Treatment facilities	
Distribution System • Pump Station • Distribution pipelines	It is assumed that pipeline alignments will follow public rights-of-way

23.2 Project Costs

Table E3-66 summarizes project capital, operating and annualized costs.

Table E3-66
Estimated Project Costs

Capital Costs	
WWTP Upgrades and Piping	$ 19 M
Environmental Mitigation	$ --
Total Capital Cost	$ 19 M
Operating Costs	
Total Annual Operating Cost	$ 475,000
Annual Costs	
Annualized Capital Costs	$ 1.38 M
Operating Costs	$ 0.47 M
Total Annual Cost	$ 1.85 M

Basis for Cost Estimates

- Capital Costs: WWTP Upgrades and Piping: Capital costs for the WWTP upgrades and piping ($19 Million) were confirmed by EBMUD (April, 2004).

- Environmental Mitigation: Mitigation costs would be limited to the cost of environmental documentation, measures to reduce environmental impacts, and acquisition of permits, if any, and may range from one to two percent of the total capital costs of individual concept development. Environmental mitigation costs are assumed to be included in the capital cost estimates and are not enumerated separately.

- Operating Costs: Operating costs were assumed 2.5% of the capital cost per year.

- Annual Costs: Lifecycle costing based on 30-year life project at 6% interest.

23.3 Outstanding Issues and Questions

- Clarify the project yield as three separate yields are listed: 1,060 AFY in the first box, 560 AFY in the opening paragraph and 1.0 MGD (1,120 AFY) in the operating description.

- Costs need to be confirmed when estimates are available.

24. EBMUD Satellite Recycled Water Project (20 AFY)

24.0 Concept Overview

24.0.1 Description

Satellite recycled water treatment plants, which take raw sewage from a sewer pipeline and treat it to a tertiary level at the location of use, can be a cost effective way to serve remotely located large water users. Satellite treatment plants avoid the need for costly infrastructure required to transport water from a centralized treatment facility to customers that are extended distances from the treatment facility. EBMUD has initiated a study to determine the feasibility of constructing satellite treatment plants within the District water service area. This study explored technologies available for satellite (or package plant) treatment systems. It also identified potential customers and included a cost-benefit analysis.

EBMUD Satellite Recycled Water Project (1,022 AFY)

Yield
Supply Yield....................... up to 20 AFY
Quality Yield ....0 AFY

Cost
Capital Cost............................. $720,000
O&M Cost..................................$18 K/yr
Unit Cost.................................$3,515/AF

Potential Partners
EBMUD

Potential customers were identified and met with to determine the feasibility of serving them. This project concept involves the design and construction of a pilot demonstration plant for feasible customers. The University of California at Berkeley could potentially be a partner in the project, and the pilot demonstration plant could possibly be located at the university to serve some of its irrigation demand. Additional satellite treatment plant projects could potentially follow a successful pilot demonstration project.

24.0.2 Potential Partners and Supply Amounts

This concept involves a partnership between EBMUD and UC Berkeley.

Table E3-67 – Potential Partner and Supply Amounts

Partner	*Type of Benefit*	*Potential Amount (AFY)*	*Notes/Issues*
EBMUD	Dry-year supply reliability	20	

Dry-Year Supply

The total available dry-year supply for the concept is 20 AFY (EBMUD, 2004)

Average Year Water Quality

There is no water quality benefit associated with this concept.

Other Potential Partners Considered but Not Included

No other potential partners were considered for this concept.

24.0.3 Operating Description

Recycled water would be produced at a pilot demonstration plant located at UC Berkeley and used for campus irrigation.

24.1 Project Facilities

Table E3-68 summarizes the proposed facilities for this concept.

Table E3-68
Project Facilities for EBMUD Satellite Concept

Facility	*Notes*
Pilot Demonstration Plant •	Located at UC Berkeley
Pipelines • Distribution Piping	To serve campus irrigation demands

24.2 Project Costs

Table E3-69 summarizes project capital, operating and annualized costs.

Table E3-69
Estimated Project Costs

Capital Costs	
Total Capital Cost	$ 720,000
Operating Costs	
Total Annual Operating Cost	$ 18,300
Annual Costs	
Annualized Capital Costs	$ 52,300
Operating Costs	$18,300
Total Annual Cost	$70,600

Basis for Cost Estimates

- Capital Costs: Capital costs associated with this concept were provided by EBMUD (EBMUD, 2004).

- Environmental Mitigation: Mitigation costs would be limited to the cost of environmental documentation, measures to reduce environmental impacts, and acquisition of permits, if any, and may range from one to two percent of the total capital costs of individual concept development. Environmental mitigation costs are assumed to be included in capital cost estimates and are not broken out separately.

- Operating Costs: Based on information from other recycled water projects in the Bay Area that mainly involve expansions of pipelines and reservoirs operating costs were conservatively assumed to be 2.5% of capital costs.

- Annual Costs: Lifecycle costing based on 30-year life project at 6% interest.

24.3 Outstanding Issues and Questions

- Need to confirm UC Berkeley is interested in project.

25. South County Recycled Water Projects (1,800 AFY)

25.0 Concept Overview

25.0.1 Description

Recycled water in South County originally began in the 1970s as a collaborative effort among the City of Gilroy, the Gavilan Water Conservation District and the South County Regional Wastewater Authority (SCRWA). The system ran sporadically for 20 years. In 1999 Santa Clara Water District (SCVWD), SCRWA and the City of Gilroy entered a partnership to further develop and extend the recycled water distribution system. Currently, SCVWD delivers recycled water produced at the SCRWA treatment plant in Gilroy to a city park, a golf course and agricultural farmland.

South County Recycled Water Projects

Yield
Supply Yield.......................... 1,800 AFY
Quality Yield................................ 0 AFY

Cost
Capital Cost .... $16.7 M
O&M Cost .... $142,000 /yr
*Unit Cost.................................$750 /AF

Partners
SCRWA, City of Gilroy, SCVWD

**Unit costs were calculated by RMC by annualizing capital adding this to O&M and dividing by yield.

The South County Water Recycled Water project concept details the improvements planned for recycled water program. These improvements include construction of two 3 MGD pump stations, construction of two 3 MGD storage reservoirs and the installation of 27,000 feet of distribution pipeline. These upgrades have not been financed and in order to proceed with these components additional funding will be needed.

25.0.2 Potential Partners and Supply Amounts

Potential partners for this project include the City of Gilroy and SCVWD. Table E3-70 provides a summary of the potential partners and long-term supply amounts. Each of these project concepts would provide a new source of supply to existing users, potentially freeing up dry-year supplies for other uses.

Table E3-70
Potential Partner and Supply Amounts

Partner	*Type of Benefit*	*Potential Amount (AFY)*	*Notes/Issues*
SCRWA	Dry-year supply reliability		
SCVWD	Dry-year supply reliability		
City of Gilroy	Dry-year supply reliability		
Total		1,800 AFY	

Dry-Year Supply

The total available dry-year supply for the Local Recycling Projects is 1,800 AFY.

Average Year Water Quality

There is no water quality benefit associated with this concept**.**

Other Potential Partners Considered but Not Included

No other potential partners have been identified at this time.

25.0.3 Operating Description

Tertiary treated recycled water will be produced at the SCRWA treatment plant in southeast Gilroy. The plant has a capacity of 3 MGD and therefore expansion will not be needed to produce the additional 1,800 AFY proposed for this concept. After production, recycled water will be distributed to golf courses, parks and farmland in the surrounding area. A recycled water master plan is currently being developed by Corollo to further refine short-term and long-term projects for recycled water expansion.

25.1 Project Facilities

Table E3-71 summarizes the proposed facilities for this concept.

Table E3-71
Project Facilities for Stanford University Recycled Water Programs

Facility	***Notes***
South County Regional Wastewater Authority (SCRWA) Storage • Two 3 MG Storage Tanks	Additional review of supply and demand projections, design, limitations, and cost analyses are needed to better define the sizes and locations of these facilities.
Pump Stations • Two 3 MGD Pump Stations	Additional review of supply and demand projections, design, limitations, and cost analyses are needed to better define the sizes and locations of these facilities.
Pipelines • Distribution piping (27,000 feet)	In general, piping alignments are assumed to follow current water utility alignments.

Basis for Facility Sizing

The facility is sized to produce 3 MGD and therefore additional expansion of the SCRWA treatment plant is not necessary. The proposed costs will be to expand the current distribution system to serve additional customers.

25.2 Project Costs

Table E3-72 summarizes project capital, operating and annualized costs (Draft HSe report, 2003).

Table E3-72
Estimated Local Recycled Water Project Costs

Capital Costs	
Distribution	$
Environmental Mitigation	$--
Total Capital Cost	$ 16.7 M
Operating Costs	
Total Annual Operating Cost	$ 142,000
Annual Costs	
Annualized Capital Costs	$ 1.2 M
Operating Costs	$ 0.142 M
Total Annual Cost	$ 1.34

Basis for Cost Estimates

Cost estimates are based on probable project costs and were provided by SCVWD.

- Capital costs: Capital costs associated with this project are based on the preliminary estimates by SCVWD.
- Environmental Mitigation: Mitigation costs would be limited to the cost of environmental documentation, measures to reduce environmental impacts, and acquisition of permits, if any, and may range from one to two percent of the total capital costs of individual concept development. Environmental mitigation costs are assumed to be included in the capital cost estimates. Annual regulatory compliance costs will vary depending on what alternative program is selected.
- Operating Costs: These costs were provided by SCVWD.
- Annual Costs: Life-cycle costing is based on 30-year life project at 6% interest.

25.3 Outstanding Issues and Questions

26. Stanford University Local Recycled Water Projects (72 - 1094 AFY)

26.0 Concept Overview

26.0.1 Description

Stanford University is currently in the process of completing a comprehensive Feasibility Study for Water Recycling. The objectives of the study are to identify: (1) alternative local and regional sources of recycled water; (2) practical uses of recycled water; (3) minimum treatment requirements for the potential sources of recycled water; and (4) a recycled water program that can be incrementally expanded.

Stanford University – Local Recycled Water Projects

Yield

Supply Yield	72 – 644; 1094* AFY
Quality Yield	0 AFY

Cost

Capital Cost	$2.6 - $15.7 M
O&M Cost	$224K – 1.7M /yr
**Unit Cost	$ 640-2,600 /AF

Partners

Palo Alto, BAWSCA , SCVWD, SFPUC

*The expanded Local Recycling Program's feasibility will need to be discussed with Palo Alto staff.

**Unit costs were calculated by RMC by annualizing capital adding this to O&M and dividing by yield.

Three main projects and potential sources of recycled water are being considered by Stanford University. The first Local Recycling Project uses the wastewater sources from the Stanford University campus that are initially discharged to the campus sewer system before being discharged to the Palo Alto Regional Water Quality Control Plant's (RWQCP). The second Recycled Water Project comprises a Local Program including the on-campus and additional nearby off-campus wastewater sources from Stanford University facilities (Stanford hospitals, Stanford Shopping Center, Welch Road lessees, Stanford West residences) that currently discharge to the Palo Alto RWQCP. This alternative is a preliminary concept and its feasibility will need to be discussed with Palo Alto staff.

The third Recycled Water Project involves Stanford's sharing part of the capital costs for Palo Alto's Regional Recycling Project and purchasing the RWQCP's recycled water (see Section 17 for discussion of the Palo Alto Recycled Water Project). The Regional Recycled Water Project potentially offers the highest available volume of recycled water. The benefit of the first and second Local Projects is that they will capture wastewater from the campus and nearby Stanford Facilities, reducing the wastewater loading on the Palo Alto sewer system and the RWQCP.

The Local Recycling Projects will also eliminate the need for installing approximately 4 miles of piping from Bay Road (east of Highway 101) to deliver the recycled water to Stanford. The first Local Project, when fully phased in could supply up to 644 AFY. The second Local Project could supply up to 1,094 AFY. The Palo Alto Regional

Recycling Project (see Section 17) could deliver up to 1,800 AFY. If Stanford participates in the Regional Recycling Program, the point of connection would be the Regional Recycled water pipeline at Bay Road in Palo Alto. This pipeline is part of the Palo Alto-Mountain View Recycled Water Program (Section 16) and the capital costs are paid by both cities and Federal grant funds. Based on initial conversations with RWQCP staff, to connect to the Regional Project pipeline at Bay Road, Stanford would need to obtain agreement from Palo Alto and Mountain View. The cost of connecting to the Palo Alto Regional system and capacity pipeline costs are not available from the City of Palo Alto. Based on preliminary conversations with RWQCP staff, HSe estimates that Stanford would be expected to pay a pipeline capacity fee estimated at potentially $1M. Based on the distance from the Stanford campus to Bay Road in Palo Alto and the size of the pipeline, HSe estimates that initial capital costs for the pipeline would be about $2.6 M. This project would require Stanford to additionally construct a recycled water distribution system, a booster station, and additional treatment facilities to treat the RWQCP recycled water for use in cooling towers and for irrigation of sensitive landscaping. The costs for the additional treatment and booster facilities are estimated at approximately $6.7 M.

26.0.2 Potential Partners and Supply Amounts

Potential partners for this project include the City of Palo Alto, SFPUC, SCVWD, and BAWSCA. Table E3-73 provides a summary of the potential partners and long-term supply amounts. Each of these project concepts would provide a new source of supply to existing users, potentially freeing up dry-year supplies for other uses.

Table E3-73
Potential Partner and Supply Amounts

Partner	*Type of Benefit*	*Potential Amount (AFY)*	*Notes/Issues*
Palo Alto, SFPUC, SCVWD, BAWSCA	Dry-year supply reliability	72 – 1,094 AFY	Includes recycled water supply from local on-campus sources and wastewater sources from off-campus Stanford facilities. Local recycling would reduce wastewater discharges to the RWQCP and SF Bay. Could offset use of SCVWD or SFPUC supply if existing users served.
Palo Alto, SFPUC, SCVWD, BAWSCA	Dry-year supply reliability	Up to 1,800 AFY	Includes recycled water supply from the Palo Alto RWQCP Regional Recycled Water Project (Section 17). Use of Regional recycling would reduce wastewater discharges to SF Bay. Could offset use of SCVWD or SFPUC supply if existing users served.
Total		72 -1,800 AFY	

Dry-Year Supply

The total available dry-year supply for the Local Recycling Projects is 72 – 1,094 AFY (HSe Draft Feasibility Study for Water Recycling at Stanford University August, 2003). The total available dry-year supply for the Palo Alto Regional Recycling Project is up to 1,800 AFY (Section 17).

Average Year Water Quality

There is no water quality benefit associated with this concept.

Other Potential Partners Considered but Not Included

No other potential partners have been identified at this time.

26.0.3 Operating Description

Currently, Stanford is in the process of completing the Feasibility Study for Water Recycling, so operating descriptions are not yet finalized. Three main recycling projects are being considered; two are Local and the third is the Palo Alto Regional Recycling Project. These projects include several alternatives that could be phased in over time. Stanford's Local Projects include seasonal storage, new recycled water distribution lines, storage tanks, pumping facilities, and a treatment plant. The Regional Recycling Project (Section 19) would require Stanford to install new recycled water distribution lines, storage tanks, additional construction of a recycled water booster station and additional treatment facilities to treat the RWQCP recycled water for use in cooling towers and for irrigation of sensitive landscaping. When fully phased in, the Local Projects could supply up to 1,094 AFY. The Regional Alternative Project would supply up to 1,800 AFY.

26.1 Project Facilities

Table E3-74 summarizes the proposed facilities for this concept.

Table E3-74
Project Facilities for Stanford University Recycled Water Programs

Facility	***Notes***
Stanford University's Local Recycled Water Projects • Seasonal storage, new distribution lines, storage tanks, pumping facilities, treatment plant. Stanford University's Participation in Regional Recycled Water Project • New distribution lines, storage tanks, pumping facilities, treatment plant.	Additional review of supply and demand projections, design, limitations, and cost analyses are needed to better define the sizes and locations of these facilities.
Pipelines • Distribution piping	In general, piping alignments are assumed to follow current water utility alignments.

Basis for Facility Sizing

The sizing and cost of new facilities at Stanford University will depend on the total recycled water demand and selected projects.

26.2 Project Costs

Table E3-75 summarizes project capital, operating and annualized costs (Draft HSe report, 2003).

Table E3-75
Estimated Local Recycled Water Project Costs

Capital Costs	
Distribution	$ 2.6 – 15.7M
Environmental Mitigation	$--
Total Capital Cost	$ 2.6 – 15.7M
Operating Costs	
Total Annual Operating Cost	$ 224,206 – 1,711,558/yr
Annual Costs	
Annualized Capital Costs	$190,000– 1,140,000/yr
Operating Costs	$224,206 – 1,711,558/yr
Total Annual Cost	$ 414,206 – 2,851,558/yr

Basis for Cost Estimates

Cost estimates are based on probable project costs included in the preliminary *Draft HSe Feasibility Study for Water Recycling at Stanford University, August 2003.*

- Capital costs: Capital costs associated with this project are based on the preliminary *HSe Draft Feasibility Study for Water Recycling at Stanford University, August 2003.*

- Environmental Mitigation: Mitigation costs would be limited to the cost of environmental documentation, measures to reduce environmental impacts, and acquisition of permits, if any, and may range from one to two percent of the total capital costs of individual concept development. Environmental mitigation costs are assumed to be included in the capital cost estimates. Annual regulatory compliance costs will vary depending on what alternative program is selected.

- Operating Costs: These costs are estimated based on information from other recycled water projects in the Bay Area that involve system power for treatment, treatment O&M, conveyance facilities maintenance, annual regulatory compliance, and power for booster pump operation (HSe, 2003).

- Annual Costs: Life-cycle costing is based on 30-year life project at 6% interest. The annualized costs varies slightly with the annualized cost presented in the Draft Feasibility Study because 5% was used in the 2003 report.

26.3 Outstanding Issues and Questions

- Need to confirm project partners.

- Need to confirm that yield of 1,094 AFY should be used to calculate upper limit of unit cost.

27. Sunnyvale Recycled Water Project (1,470 AFY)

27.0 Concept Overview

27.0.1 Description

This project involves the expansion of recycled water use within the service area of Sunnyvale's Water Pollution Control Plant for irrigation and other purposes. This project would provide recycled water to potential users that are already connected to the recycled water system. It may be possible to extend the distribution to new users if additional funding is secured. However, since yield and cost data for such an expansion is not available, it is not included in the concept.

Sunnyvale Project

Yield
Supply Yield................. up to 1,470 AFY*
Quality Yield ....0 AFY

Cost
Capital Cost............................. $18-21 M
O&M Cost.............................$45-53 K/yr
Unit Cost....................$1,200-$1,400 /AF

Potential Partners
Sunnyvale, BAWSCA, SFPUC

*Yield was updated with estimate provided by Val Cozet to Marinda Thomas (RMC) in May 2004.

27.0.2 Potential Partners and Supply Amounts

This project would provide a new source of supply to existing users, potentially freeing up dry-year supplies for other uses. Existing supplies include high quality SFPUC supplies, groundwater, and SCVWD supply. This project would also allow for additional reductions in discharge to the South Bay (thereby preserving the salt march ecosystem). Table E3-76 provides a summary of the potential partners and long-term supply amounts.

Table E3-76
Potential Partner and Supply Amounts

Partner	***Type of Benefit***	***Potential Amount (AFY)***	***Notes/Issues***
Sunnyvale	Dry-year supply reliability	Up to 1,470	Would serve north Sunnyvale. May offset potable water use from SFPUC, if existing users are served.

Dry-Year Supply

The total available dry-year supply for the concept is 1,470 AFY (Conzet, 2004).

Average Year Water Quality

There is no water quality benefit associated with this concept.

Other Potential Partners Considered but Not Included

No other potential partners were considered for this concept.

27.0.3 Operating Description

Recycled water would be produced at the Sunnyvale WPCP and distributed to customers within the service area for irrigation and other uses. Depending on the scale of the project, minimal upgrades would be needed at the WPCP. Current future plans are to provide recycled water to potential users that are already connected to the system.

27.1 Project Facilities

Table E3-77 summarizes the proposed facilities for this concept.

Table E3-77
Project Facilities for Sunnyvale Concept

Facility	***Notes***
Recycled Water facilities - Improvements at the Sunnyvale WPCP	Some minimal upgrades would be required.
Pipelines - Distribution Piping	Service would be provided to north Sunnyvale where current infrastructure can already convey recycled water. Other extensions would provide RW to outlying users. It is assumed that pipeline alignments will follow public rights-of-way

27.2 Project Costs

Table E3-78 summarizes project capital, operating and annualized costs.

Table E3-78
Estimated Project Costs

Capital Costs	
Total Capital Cost	$ 18-21 M
Operating Costs	
Total Annual Operating Cost	$ 0.45-0.53 M
Annual Costs	
Annualized Capital Costs	$ 1.3 - 1.5M
Operating Costs	$ 0.45 - 0.53M
Total Annual Cost	$ 1.8 - 2.0 M

Basis for Cost Estimates

- Capital Costs: Capital costs associated with this concept were based on the calculated per acre foot average from six similar projects identified in the concept elements ($1200-$1400/AF). The total capital cost was then calculated by RMC by multiplying the unit cost by the yield of 1,470 AFY while assuming that O&M is 2.5% of Capital.

- Environmental Mitigation: Mitigation costs would be limited to the cost of environmental documentation, measures to reduce environmental impacts, and acquisition of permits, if any, and may range from one to two percent of the total capital costs of individual concept development. Environmental mitigation costs are assumed to be included in capital cost estimates and are not broken out separately.

- Operating Costs: Based on information from other recycled water projects in the Bay Area that mainly involve expansions of pipelines and reservoirs operating costs were conservatively assumed to be 2.5% of capital costs.

- Annual Costs: Lifecycle costing based on 30-year life project at 6% interest.

27.3 Outstanding Issues and Questions

- Need to confirm potential partners.

- Current cost estimates were based on averages from other similar recycled water projects in the Bay Area. These costs need to be confirmed.

28. Engineering Analysis

28.0 Project Costs

This section provides an analysis of Project Costs for engineering aspects of the concept that will be assessed in the scorecard.

28.1 System Vulnerability

Since concepts provide non-potable supplies, they do not reduce system vulnerability of the potable systems of potential partnering agencies.

28.2 Supply Reliability

Concepts provide dry-year supply reliability, with a drought-proof supply for project users. Concepts that serve recycled water to existing users potentially free up water that can be used to meet other potable uses within the partnering agency service area.

28.3 Water Quality

Concepts would not provide water quality benefits to participants. Although some concepts could free up use of high quality SFPUC supplies, SFPUC wholesale customers and SCVWD customers have not expressed interest in use of additional SFPUC supply for blending. EBMUD water right considerations would preclude the exchange of EBMUD water to other agencies.

Reclaimed water concepts implemented over groundwater basins could potentially degrade potable water quality in those areas. Increased TDS and TOC resulting from recharge by reclaimed water could translate to increased treatment costs for agencies relying on groundwater supplies for potable use.

29. Environmental Analysis

This section summarizes the environmental analysis for these concepts under the general environmental categories that will be presented in the detailed concept and portfolio evaluation (the "scorecard"). A more comprehensive environmental summary is included as Appendix A.

29.1 Potential Environmental Benefits

Environmental benefits are defined as an overall improvement to some aspect of environmental quality, to the land, air, or water. The potential benefits associated with the proposed concepts include offsetting the development of higher capacity water supply projects. This translates to a potential reduction in environmental impacts associated with the construction and operation of water-related facilities. For some concepts, additional benefits are associated with decreases in the amount of wastewater discharged into the Bay and potential enhancement of habitat and species health in salt marsh ecosystems where wastewater flows would be reduced.

29.2 Potential Environmental Impacts

Environmental impacts are defined as potential degradation in the quality of the environment that will likely require mitigation. Table E3-79 summarizes potential environmental impacts for the project, identifying the issue area, potential impacts and mitigation opportunities for aquatic resources, terrestrial resources, wetlands and energy consumption. Other potential environmental impacts, including but not limited to land use and construction-related effects, are discussed in Appendix A.

Table E3-79
Potential Environmental Impacts and Mitigation Opportunities
Reclamation

Issue Area	***Potential Effects***	***Mitigation Opportunities***
Aquatic Resources	Potential impacts to aquatic resources if improperly treated reclaimed water is discharged into biologically-sensitive areas.	Comply with Title 22 requirements (EDAW, 2004).
Biological Resources (Terrestrial)	Effects on sensitive habitats and associated special-status species from siting of facilities within areas of sensitive biological resources (EDAW, 2004).	Further studies on a case-by-case basis to identify the type and amount of habitats and species affected. Measures that could reduce potential impacts include: conduct protocol-level surveys, locate facilities to avoid sensitive biological resources, implementation of BMPs, monitoring, acquisition of permits as needed and implementation of permit conditions, and revegetation.

Table E3-79
Potential Environmental Impacts and Mitigation Opportunities
Reclamation

Issue Area	***Potential Effects***	***Mitigation Opportunities***
Wetlands	Elimination or reduction of wetlands, other sensitive habitats, or special-status / sensitive species if facilities occur within or adjacent to wetlands resources. (EDAW, 2004). In some cases, the reduction of treated wastewater into the Bay could benefit the salt march ecosystems.	Avoid or minimize impacts to sensitive biological resources through alternative siting; conduct relevant surveys; implement BMPs; restrict construction schedule; acquire permits as necessary; compliance with permit conditions (e.g., replacement at a ration deemed appropriate by regulatory agencies) (EDAW, 2004).
Energy	The energy consumption differs for each facility, depending on individual capacities. Generally, 1,000 – 2,000 kWh would be used per million gallons of water treated (RMC, 2004). Operation of the proposed facilities would require consumption of non-renewable energy. Energy demand associated with individual reclamation plants would likely require a small fraction of PG&E resources (EDAW, 2004).	NA

30. Regulatory and Institutional Analysis

This section summarizes the regulatory and institutional evaluation for this concept for the general categories that will be assessed in the detailed concept and portfolio evaluation (the "scorecard").

30.1 Permitting

Permits that are typical to construction and operation of infrastructure projects (i.e., pipelines and pump stations) include those from the U.S. Army Corps of Engineers, Regional Water Quality Control Board (RWQCB), and California Department of Fish and Game, and local and regional agencies where these facilities are located. The specific permits unique to development of reclamation facilities include RWQCB's General Order 96-011. The Order is intended to serve as a region-wide general permit for publicly owned wastewater and water agencies that recycle treated municipal wastewater. As part of the Order, RWQCB is required to consult with the Department of Health Service (DHS).

The permitting process may last one to two years, depending on the time required for CEQA/NEPA compliance and permit acquisition. The permits identified above would require generally the same time length – approximately a year. Delta Diablo Sanitation District (DDSD) took about two years to build its reclamation facility following completion of the environmental compliance, including permit acquisition and construction (Wong, 2004). To shorten the duration, the permit process could occur in parallel with the CEQA/NEPA environmental process; however, that would require development of adequate engineering and design details for submittal to the RWQCB and DHS.

For a list of anticipated permitting and consultation requirements, refer to Appendix A.

30.2 Institutional Issues

If the reclamation facilities are located on private or public parcels not owned by the participating agenc(ies), agenc(ies) would purchase land from land-owners on a willing-buyer basis or lease land, as appropriate. Negotiations for land acquisition or leasing would occur prior to the development of the project.

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Appendix E3.A

Summary of Environmental Analysis Recycled Water Concepts

Table E3.A-1
Potential Environmental Impacts and Mitigation Opportunities
Recycled Water Concepts

Issue Area	***Potential Effects***	***Mitigation Opportunities***
Water Quality / Public Health	Reclaimed water may have high TDS, metals, microorganisms, salts, and nitrates; irrigation with reclaimed water could degrade surface / ground water quality, and affect crop yields (EDAW, 2004).	Appropriate level of treatment; blending with higher quality water to reduce TDS levels; compliance with DHS requirements; operating above-ground irrigation systems per requirements of Title 22 of the California Code of Regulations (matching irrigation to the evapotranspiration rates of the plants and crops being irrigated; prohibit application of reclaimed water within 50 feet of creeks or wells); avoidance of recharge areas (EDAW, 2004).
	Potential for emerging pollutants / endocrine disrupting compounds to enter the water system (via groundwater or mixing with freshwater). In areas where groundwater provides drinking water, potential contamination could be a problem (EDAW, 2004).	Further studies would be required to assess the potential for water supply contamination from emerging pollutants in recycled water.
Hydrology	Potential for siting within floodplain areas (EDAW, 2004). Reduction of freshwater discharge (treated wastewater) into the Delta may affect freshwater balance in the Delta (applicable to CCCSD and DDSD projects only) (CDM).	Flood-proof facilities per FEMA and County requirements (EDAW, 2004). Further studies would be required to assess the potential for imbalance of freshwater in the Delta and resulting solutions if such is the case (E).
Aquatic Resources	Potential impacts to aquatic resources if improperly treated reclaimed water is discharged into biologically-sensitive areas.	Comply with Title 22 requirements (EDAW, 2004).
Biological Resources	Effects on sensitive habitats and associated special-status species from siting of facilities within areas of sensitive biological resources (EDAW, 2004). Elimination or reduction of wetlands, other sensitive habitats, or special-status / sensitive species from facility or pipeline location (EDAW, 2004).	Further studies on a case-by-case basis to identify the type and amount of habitats and species affected. Measures that could reduce potential impacts include: conduct protocol-level surveys, locate facilities to avoid sensitive biological resources, implement BMPs, monitoring, acquisition of permits as needed and implementation of permit conditions (e.g., replacement at a ratio deemed appropriate by regulatory agencies), and revegetation.

Table E3.A-1
Potential Environmental Impacts and Mitigation Opportunities
Recycled Water Concepts

Issue Area	***Potential Effects***	***Mitigation Opportunities***
Land Use	Land use conflicts with siting of facilities (if located outside the footprints of an existing plant), including designated uses, adopted plans and policies for the following components (EDAW, 2004): ▪ Recycled water facility ▪ Groundwater extraction wells (if needed) ▪ Transmission pipelines ▪ Pump stations	Site facility within appropriate land uses if outside the footprint of existing plants (EDAW, 2004).
	Operation land use impacts (e.g., noise, visual quality) that could affect sensitive receptors (EDAW, 2004).	Noise attenuation through muffling and enclosures; design facility to integrate with surrounding uses) (EDAW, 2004).
Soils and Geology	Potential for siting within areas of soil instability, areas susceptible to high groundshaking and other secondary seismic impacts (EDAW, 2004).	Develop geotechnical studies; design and engineer facilities per UBC code.
Cultural Resources	Potential effects to known or unknown resources (EDAW, 2004)	Standard procedures to implement in the event of a find (EDAW, 2004).
Growth Inducement	Water may be used to offset drinking water needs such that potable drinking water could be used to meet demands associated with approved growth.	Mitigation measures of affected jurisdictions' General Plans or development projects may reduce secondary growth-related effects.
Construction Activities	General disruption of land uses from construction noise, dust, traffic, stormwater effects on adjacent creeks, etc. (EDAW, 2004)	Standard BMPs, traffic control plan, construction schedule limitations, etc. (EDAW, 2004)
Energy	The energy consumption differs for each facility, depending on individual capacities. Generally, 1,000-2,000 kWh would be used per million gallons of water treated (RMC, 2004). Operation of the proposed facilities would require consumption of non-renewable energy. Energy demand associated with individual reclamation plants would likely require a small fraction of PG&E resources (EDAW, 2004).	NA

Table E3.A-2
Summary of Permitting and Consultation Requirements
Recycled Water Concepts

Agency	***Type of Permit***
United States Army Corps of Engineers	Section 404/10, General or Individual
California Department of Fish and Game	Streambed Alteration Agreement
Regional Water Quality Control Board	General Construction Activity Storm Water Permit
Regional Water Quality Control Board	General Order 96-11 (General Water Reuse Order)
Bay Area Air Quality Management District Authority	Authority to Construct and Permit to Operate (stationary sources that emit pollutants)
Various	Relevant encroachment permits

E4. Regional Desalination Project

Appendix E4
Regional Desalination Project

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Appendix E4
Regional Desalination Project

1. Overview

Five desalination concepts have been selected for analysis as part of the BAWQ&SRP study. These are the Regional Desalination Concept, Mirant Desalination with Water Quality Element, Near Bay Bridge Desalination with Water Quality Element, South Bay Desalination, and East Bay Saline Groundwater Desalination.

The Regional Desalination Project concept refers to the efforts underway by the Regional Desalination Partners (RDP) (i.e., East Bay Municipal Utility District (EBMUD), Contra Costa Water District (CCWD), San Francisco Public Utilities Commission (SFPUC), and Santa Clara Valley Water District (SCVWD)) who are currently exploring the feasibility of desalination for meeting the water supply reliability needs of their agencies. In Phase I of the RDP, three desalination facilities were identified for further evaluation: Mirant Desalination (40 or 120 MGD), Near Bay Bridge Desalination, and Oceanside Desalination. The Regional Desalination Project will continue to analyze these projects as part of an ongoing effort. To date, the RDP has not made determinations regarding what (if any) facility(ies) will be constructed, who will receive what quantity of water and through what mechanism that water will be conveyed. These determinations will be made as the project progresses in subsequent phases of the RDP. The initial concept in this study, the Regional Desalination Project concept, refers to those efforts, and uses information from the Phase I report, the Bay Area Regional Desalination project Pre-Feasibility Study Final Report of October, 2003[1] to define the concept.

The additional concepts in this study include Mirant Desalination (at Antioch or Pittsburg) with Water Quality Element, Near Bay Bridge Desalination with Water Quality Element, South Bay Desalination concepts, and East Bay Saline Groundwater Desalination. The Mirant Desalination and Near Bay Bridge Desalination concepts are conditional in that Zone 7 is not currently part of the RDP and operations would be reliant on available capacity which cannot be confirmed in the timeframe of this study. In addition, both concepts would make use of the same facilities; as such, only one of the two concepts would be pursued[2]. The South Bay Desalination concepts and the East Bay Saline Groundwater Desalination concept are also independent of the RDP. The South Bay Desalination concept was originally presented in the RDP, but was not selected to be carried forward for further evaluation by that study.

---

[1] Bay Area Regional Desalination Pre-Feasibility Report, URS/Boyle, October, 2003, is referenced as RDP PFR, 2003.

[2] It would be infeasible for both the Mirant and Near Bay Bridge with Water Quality Element concepts to be carried forward at the same time, as both concepts rely upon a finite amount of available capacity within the EBMUD distribution system during average years. Both concepts will be analyzed as part of the BAWQ&SRP study.

Each of the concepts being considered in this study is described in further detail in subsequent sections of this document. Sections 2 through 6 describe each of the desalination concepts separately: the RDP, Mirant Pittsburg with Water Quality Element, Near Bay Bridge with Water Quality Element, South Bay Desalination concepts, and East Bay Saline Groundwater Desalination. Sections 7, 8 and 9 present general engineering analysis, environmental analysis, and permitting considerations for desalination in general, as well as for each proposed concept.

In addition to the desalination concepts included in this report, the Northern California Salinity Coalition is working with its members to identify opportunities for a variety of projects including smaller pilot projects.

2. Regional Desalination Project (RDP)

2.0 Concept Overview

2.0.1 Description

The Bay Area Regional Desalination Project (RDP) is intended to improve supply reliability for the residents and businesses served by partner agencies by developing a desalination plant, or plants, at a site, or sites, that will provide benefit, either directly or indirectly, to each of the agencies that choose to participate. The RDP could potentially provide an additional source of water during emergencies, provide supplemental supply during extended drought periods, allow increased flexibility in taking other facilities offline for repairs, or provide a full-time, all weather supplemental supply, increasing the diversity of supplies for the partner agencies. The plant(s) will be developed with production capacity of up to 120 MGD of product water. Alternatively, multiple plants may be constructed with capacities of 20 MGD each or greater. All partners are intended to benefit from the facility, either through receiving desalinated water directly, or by receiving water from another agency that receives desalinated water. The Regional Desalination Project explored thirteen potential desalination locations, and evaluated the sites based on seven criteria: feedwater quality, cost of product water, permitting/water rights requirements, public acceptance/socioeconomic effects, potential for grant funding, capability of supplying multiple agencies, environmental effects. Three potential desalination sites were identified for further evaluation in subsequent phases of the Study: Mirant Pittsburg Plant, Pittsburg; Oceanside, San Francisco; and Near Bay Bridge, Oakland.

Mirant Pittsburg[3]

The Mirant Pittsburg desalination facility would be co-located with the Mirant Pittsburg Power Plant in Pittsburg, California. Reasons for its selection included existing intake and outfall structures, high-quality source water, economical energy source, and proximity to CCWD and EBMUD transmission facilities.

Near Bay Bridge

The Near Bay Bridge desalination facility would be located in close proximity to EBMUD's wastewater treatment plant in Oakland, on the eastern side of the Bay Bridge. The existing outfall structure and proximity to EBMUD transmission facilities of this location were cited as benefits.

Oceanside

The Oceanside, San Francisco desalination facility would be located on the western shore of the Peninsula within San Francisco, possibly adjacent to the existing Oceanside wastewater treatment plant. The Oceanside site has an existing outfall with capacity available for operation of a desalination facility. In addition, concentrate discharged into the ocean would disperse more readily than concentrate discharged into the Bay-Delta, providing a potential environmental advantage for this site.

---

[3] The Pittsburg and Antioch sites evaluated in the RDP scored equally well. Rather than retaining both sites, the RDP selected Pittsburg site for further evaluation. The BAWQ&SRP Mirant with Water Quality Element concept retains both Pittsburg and Antioch as potential sites.

2.0.2 Partners and Supply Amounts

Table E4-1 summarizes the partners and supply amounts for this concept.

Table E4-1
Regional Desalination Project
Partners and Supply Amounts

Partner	Type of Benefit	Potential Amount (AFY)	Notes/Issues
CCWD	Supply Reliability	Mirant Pittsburg: Up to 129,000 AFY Near Bay Bridge: Up to 43,000 AFY Oceanside: Up to 43,000 AFY	TBD(1)
EBMUD			TBD(1)
SFPUC(2)			TBD(1)
SCVWD			TBD(1)

(1) To be determined in future phases of the Regional Desalination Project.

(2) For the purposes of this study, SFPUC includes retail customers and the 28 wholesale customers, BAWSCA member agencies.

Dry Year Supply

The total available dry-year supply for the 120 MGD Mirant Pittsburg Desalination alternative is 129,000 AFY, based on a 120 MGD plant capacity with the plant operated 95 percent of the time during drought years[4]. For the 40 MGD Mirant Pittsburg, Near Bay Bridge, and Oceanside Desalination alternatives, the total available dry-year supply is estimated to be 43,000 AFY, based on a 40 MGD plant capacity with the plant operated 95 percent of the time during drought years (RDP PFR, 2003).

Average Year Water Quality

The RDP is not including alternatives for water quality benefits; projects are being considered for increased supply reliability. Water quality benefits or impacts would depend upon site(s) selected, level of treatment, source and quantity of water received by which agency.

Other Partners Considered But Not Included

No additional partners have been identified to date. As cooperative studies among the RDP partnership continue, opportunities for others to participate will likely be discussed. The timing of this is uncertain. Phase 2 work for the RDP will identify criteria and process for potentially including additional partners.

---

[4] Due to varied objectives of the RDP partners, the 95% operation factor was used for all years to develop a cost estimate. Work will be conducted in Phase 2 of the RDP studies to further define the capacities, operational modes and costs.

2.0.3 Operating Description

Either one plant with production capacity up to 120 MGD or multiple plants with capacities of up to 40 MGD may be constructed. Which plant(s) and which combination(s) are to be determined during the feasibility stage of the RDP study.

Mirant Pittsburg

The Mirant Pittsburg Plant site would be located at the 2,060 MW power plant near Pittsburg, within the CCWD service area and in close proximity to the Mokelumne Aqueduct, CCWD Contra Costa Canal and Multipurpose Pipeline. The power plant has a permitted annual flow of 658 MGD, and is 1,080 acres in size. The desalination site could be located outside the jurisdictional boundaries of the Bay Conservation and Development Commission (BCDC) on the power plant site. Two potential sizes are being considered for this alternative: 40 MGD and 120 MGD.

Near Bay Bridge

A 40 MGD desalination site could be located in close proximity to the EBMUD wastewater treatment facility serving 640,000 people in Alameda and Contra Costa counties. The wastewater discharge line and outfall could potentially be used by a desalination facility if recirculation can be minimized.

Oceanside

A 40 MGD Oceanside facility could be located along the western shore of San Francisco. The location should be near the Oceanside wastewater treatment plant, allowing seawater to be used as a feedwater source, and brine discharge to be blended with wastewater discharge. Strong currents and tidal flushing would assist in brine disposal.

2.1 Project Facilities

Figure E4-1 and Table E4-2 summarize the potential facilities for this concept.

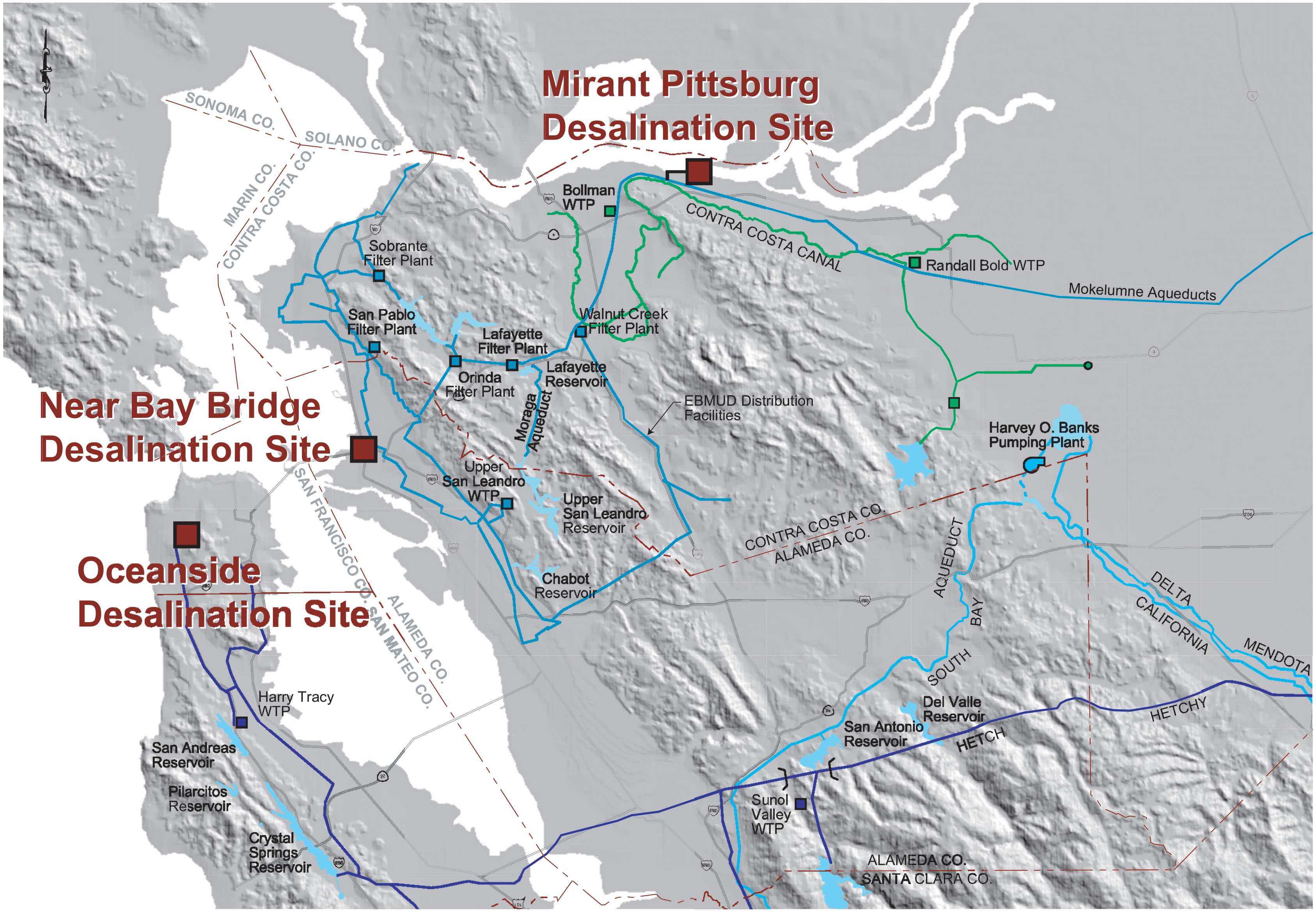

Figure E4-1
Regional Desalination Project Potential Sites

Table E4-2
Regional Desalination Project
Project Facilities(1)

Facility	*Notes*
Mirant Pittsburg Plant Site	
Desalination Facility • Intake obtaining water from the power plant cooling system (63 mgd for 40 MGD alternative, 188 MGD for 120 MGD alternative) • Pre- and post-treatment systems (40 MGD permeate for 40 MGD alternative, 120 MGD permeate for 120 MGD alternative) • Reverse osmosis treatment system • Brine disposal via power plant cooling water return	Two pass system with energy recovery, 150 mg/L TDS permeate, 200 mg/L delivered water quality post-treatment.
Pump Station • Treated Water Pump Station (500' lift)	
Pipelines **Product Water Delivery** *120 MGD Alternative* • 72" diameter pipeline, up to 3 miles. *40 MGD Alternative* • 48" diameter pipeline, up to 3 miles.	
Near Bay Bridge Site	
Desalination Facility • Pre- and post-treatment systems • 40 MGD reverse osmosis treatment • 48 MGD brine disposal via the treated wastewater outfall • Energy recovery device installed in plant	Two pass system with energy recovery, 200 mg/L TDS combined permeate, 300 mg/L product water after post-treatment
Pump Station • Treated Water Pump Station (100 feet lift)	
Pipelines **Raw Water Intake** • 72" diameter pipeline, up to 3 miles. **Product Water Delivery to EBMUD System** • 48" diameter pipeline, up to 2 miles.	88 MGD intake in San Francisco Bay at depth of over 20'
Oceanside Site	
Desalination Facility • New 88 MGD ocean intake (2 miles, 6' diameter) • Pre- and post-treatment systems • 40 MGD reverse osmosis treatment • Brine disposal via existing WWTP outfall	Two pass system with energy recovery, 200 mg/L TDS permeate, 300 mg/L TDS product water after post-treatment.
Pump Station • Treated Water Pump Station (400 feet lift)	
Pipelines **Raw Water Intake** • 72" diameter pipeline, up to 2 miles. **Product Water Delivery to SFPUC System** • 48" diameter pipeline, approximately 3 miles.	88 MGD Pacific Ocean intake Product water delivery to Sunset Reservoir

(1) Information from the Regional Desalination Project Pre-Feasibility Report (RDP PFR, 2003).

Basis for Facility Sizing

Information on potential facilities and sizing obtained from RDP Prefeasibility Report (RDP PFR, 2003).

2.2 Project Costs

Table E4-3 summarizes estimated costs for this concept, in 2003 dollars.

Table E4-3
Regional Desalination Project
Estimated Project Costs[1,2] ($Million, 2003 dollars)

	Mirant Pittsburg Plant (40 MGD)	***Mirant Pittsburg Plant (120 MGD)***	***Near Bay Bridge (40 MGD)***	***Oceanside (40 MGD)***
Capital Costs				
Desalination Plant On-Site Facilities	$146.3	$420.8	$229.4	$245.2
Raw Water Intake	$2.0	$5.0	$10.0	$20.0
Product Water Facilities	$20.0	$40.0	$20.0	$20.0
Total Capital Cost	**$168.3**	**$465.8**	**$259.4**	**$285.2**
O&M Costs				
Labor	$1.0	$2.0	$1.0	$1.0
Power	$8.3	$27.7	$21.1	$24.4
Chemicals, Membrane Replace, Misc. Maintenance	$7.4	$21.5	$12.3	$12.8
Total O&M Cost	**$16.7**	**$51.2**	**$34.4**	**$38.2**
Annual Costs				
Annualized Capital Costs	$12	$32	$18	$20
Operating Costs	$17	$51	$34	$38
Total Annual Cost	**$29**	**$83**	**$52**	**$58**

(1) Information from the Regional Desalination Project Pre-Feasibility Report (RDP PFR, 2003).

(2) Due to varied objectives of the RDP partners, the 95% operation factor was used for all years to develop a cost estimate. Work will be conducted in Phase 2 of the RDP studies to further define the capacities, operational modes and costs.

2.2.1 Basis for Cost Estimates

Capital Costs:

- Desalination Plant: Regional Desalination Study capital cost estimates, $2003.
- Environmental Mitigation: To be determined by Regional Desalination project.
- Operating Costs: Regional Desalination Study, $2003.
- Annual Costs: Regional Desalination Study. Capital cost amortized assuming 5.5% for 30 years, $2003.

- Additional costs associated with exchange of water to indirect RDP recipients are projected, and are not included in the above estimates.

2.3 Outstanding Issues and Questions

The Regional Desalination Project will determine what, if any, desalination facility is constructed. In addition, the RDP will determine how much water each agency will receive and by what mechanism.

3. Mirant Pittsburg or Antioch Desalination with Water Quality Element (25 MGD)

3.0 Concept Overview

3.0.1 Description

The Mirant Pittsburg or Antioch Desalination with Water Quality Element concept would involve the conveyance of up to 25 MGD of desalinated water in average years to Zone 7 for water quality blending. This concept provides an incremental water quality benefit beyond the Regional Desalination Project. It assumes co-location of an up to 40 MGD desalination plant at either the Mirant Pittsburg Power Plant, in Pittsburg, or the Mirant Contra Costa Power Plant in Antioch, as described by the Regional Desalination Project.

This concept is an extension of the project described in the Bay Area Regional Desalination Project Pre-Feasibility Study (RDP PFR, 2003). It has not been evaluated by the Regional Desalination Project.

In addition to the RDP project and this concept, the NCSC has endorsed a smaller 5 to 15 mgd demonstration project that would use several existing intakes along 20 miles of the Contra Costa County shoreline. This type of demonstration project would be designed to address uncertainty related to cost, benefit, and regulatory uncertainties. An RW Beck study on the demonstration project is being finalized and results may be included in future RDP studies.

In contrast to the regional study, which evaluated this concept only for dry-year supply, this study evaluated the potential to also provide average year water quality benefits to agencies participating in the BAWQ&SRP that are not currently Regional Desalination Project partners.

3.0.2 Potential Partners and Supply Amounts

Table E4-4 summarizes potential partners for an alternate configuration of the Mirant desalination concept. Zone 7 Water Agency would potentially be interested in water quality for blending and/or for groundwater storage and subsequent extraction for drought supply.

Water could potentially be delivered through existing interconnections to Zone 7 customer Dublin-San Ramon Services District (DSRSD) during non-peak periods, or to a new interconnection to the Zone 7 system from the EBMUD system in San Ramon. Conceptual-level facilities and cost estimates for the concept are developed using information from the regional desalination study (RDP PFR, 2003) and from evaluation from earlier studies of the EBMUD and Zone 7 systems.

Table E4-4
Mirant Pittsburg or Antioch Desalination with Water Quality Element
Potential Partner and Supply Amounts

Partner	*Type of Benefit*	*Potential Amount (AFY)*	*Notes/Issues*
CCWD	Dry-year supply (RDP)	TBD	The Mirant Desalination facility will be sized to produce up to 43,000 AFY. Deliveries could be made via the Multi-purpose Pipeline (MPP) (treated). The MPP has a capacity of 25 MGD. CCWD could also deliver up to 40 MGD to the Contra Costa Canal (untreated). Specific plant locations, allocations or exchange between EBMUD and CCWD or with other partner agencies will be determined as part of the Regional Desalination Project.
EBMUD	Dry-year supply (RDP)	TBD	The Mirant Desalination facility will be sized to produce up to 43,000 AFY. Deliveries could be made via the Mokelumne Aqueduct (untreated). Water would be re-treated at EBMUD's Walnut Creek, Lafayette and/or Orinda WTPs. Specific plant locations, allocations or exchange between EBMUD and CCWD or with other partner agencies will be determined as part of the Regional Desalination Project.
SFPUC(1)	Dry-year supply (RDP)	TBD	All RDP partners will benefit from the desalination facility in dry years. The quantity and operations will be determined in future phases of the RDP process.
SCVWD	Dry-year supply (RDP)	TBD	All RDP partners will benefit from the desalination facility in dry years. The quantity and operations will be determined in future phases of the RDP process.
Zone 7 Water Agency	Average Year Water quality	Up to 15,000 AFY	Deliveries via new 25 MGD connection during November through March between EBMUD and Zone 7, for direct delivery for blending, or for storage in groundwater basin for subsequent extraction.

(1) For the purposes of this study, SFPUC includes retail customers and the 28 wholesale customers, BAWSCA member agencies.

Dry Year Supply

CCWD and EBMUD are assumed to be potential recipients of water for dry-year supply reliability from the base desalination facility that is part of the RDP. The total available dry-year supply for the concept is 43,000 AFY, based on a 40 MGD plant capacity, with the plant operated 95% of the time during drought years (RDP PFR, 2003).

Potential dry-year supply amounts for each agency were estimated based on the following assumptions:

- CCWD -- Up to 40 MGD (43,000 AFY, at a 95% plant factor).
- EBMUD -- Up to 40 MGD (43,000 AFY, at a 95% plant factor).

Average Year Water Quality

Zone 7 is a potential participant for average year water quality. Deliveries to Zone 7 would be through EBMUD's distribution system in the San Ramon Valley, with a new interconnection sized to deliver up to 25 MGD to the Zone 7 system. Deliveries would be limited to lower demand periods (generally November through March, possibly extending into April or May) when unused capacity is available in the EBMUD distribution system.

Potential average year water quality supply amounts for each agency have been estimated based on the following assumptions:

- Zone 7 -- Up to 25 MGD, with deliveries from November through May (15,000 AFY, using a 95% plant factor during delivery months)[5].

Other Partners Considered But Not Included

The following other potential partners were considered but not included.

Table E4-5
Mirant Pittsburg or Antioch Desalination with Water Quality Element
Other Partners Considered But Not Included

Agency	***Type of Benefit***	***Reason Not Included***
ACWD (convey through City of Hayward system)	Average Year water quality	Not interested in being considered as a project beneficiary independently from what they receive from the SFPUC regional system.
BAWSCA	Average Year water quality	Not interested in being considered as a project beneficiary independently from what they receive from the SFPUC regional system or SCVWD system.

3.0.3 Operating Description

The desalination concept would obtain raw water from the Mirant power plant cooling system, and use the power plant's cooling water return line for brine disposal. Treated water would be conveyed from the desalination plant to CCWD's Multi-Purpose Pipeline (MPP), or the Contra Costa Canal, and/or to EBMUD's Mokelumne Aqueduct. EBMUD's Mokelumne Aqueduct delivers raw water to EBMUD's Walnut Creek, Lafayette and Orinda water treatment plants, where water would be treated.

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[5] The full 25 MGD of capacity may not be continuously available in Apr-May through the EBMUD transmission and distribution system. Additional study will be required. In addition, deliveries to others through the EBMUD system would be on an interruptible basis and of lower priority than operations for EBMUD customers.

Water could be conveyed to the Zone 7 distribution system via a new intertie connecting the southern part of EBMUD's San Ramon Valley system with Zone 7 transmission facilities. This study assumed an intertie size of up to 25 MGD. A new regulating station and up to 40,000 feet of new pipeline would be required.

Water for water quality blending would be delivered to Zone 7 during normal and wet years, during winter months (November through March, possibly extending into April and May), when excess capacity is available in the EBMUD distribution system. Zone 7 could use the water directly to blend with other supplies, or could potentially inject the water into its groundwater basin for subsequent extraction. Further study would be required to determine the feasibility of groundwater injection and the benefits to the groundwater basin salt management plan.

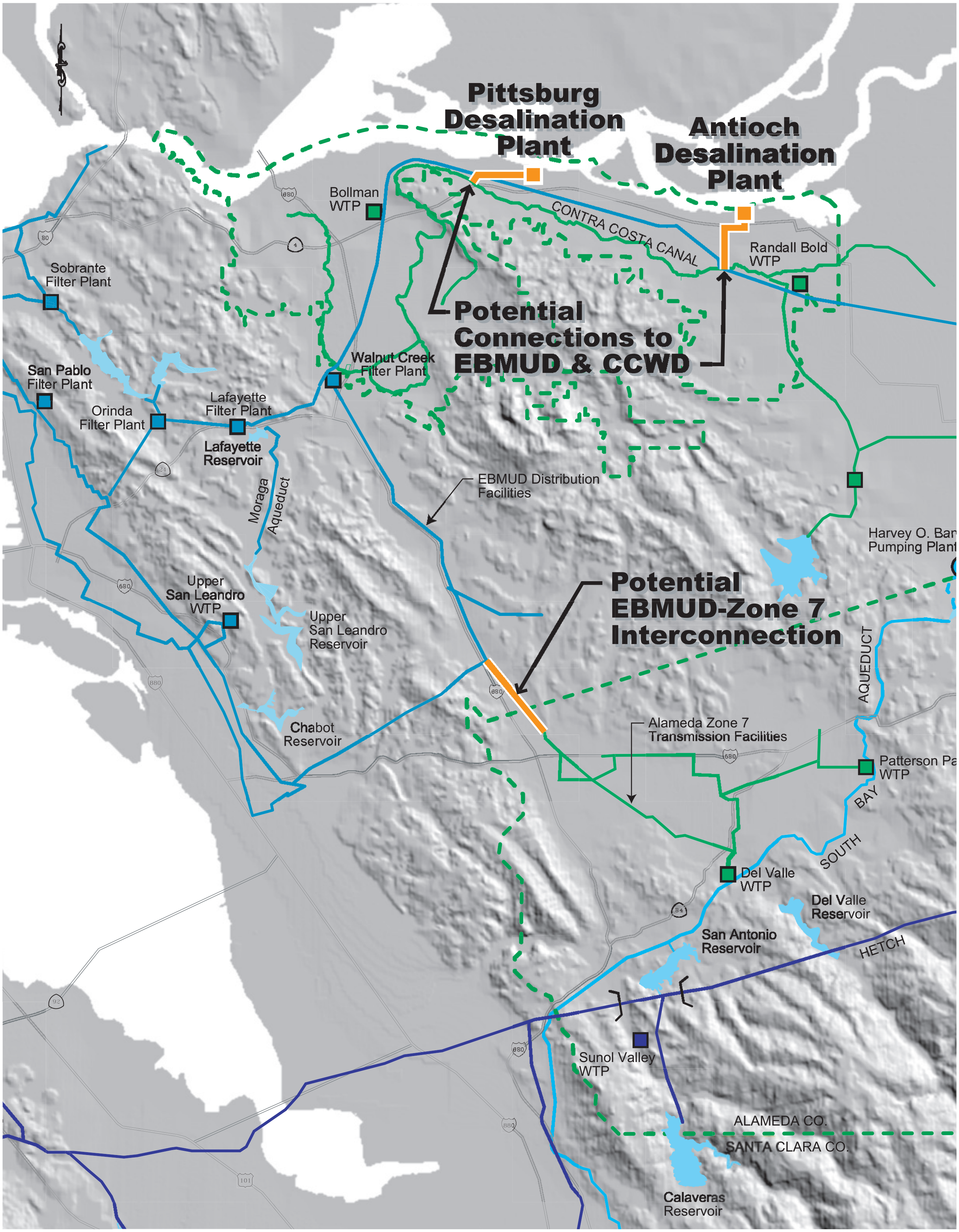
3.1 Project Facilities

Figures E4-2 and E4-3, and Table E4-6 summarize the proposed facilities for this concept.

Table E4-6
Mirant Pittsburg or Antioch Desalination with Water Quality Element
Project Facilities

Facility	*Notes*
Desalination Facility - RDP • Intake obtaining water from the power plant cooling system (630 MGD) • Pre- and post-treatment systems • Reverse osmosis treatment system (40 MGD permeate) • Brine disposal via power plant cooling water return (23 MGD)	Two pass system with energy recovery, 150 mg/L TDS permeate, 200 mg/L delivered water quality post-treatment.
Pump Station(1) • 4,800 HP Treated Water Pump Station (40 MGD, 370 feet lift)	Lift based on approximate Mokelumne Aqueduct gradient of 380 feet. Connection to MPP would be similar operating gradient.
Pipelines(1) **From Plant to EBMUD/CCWD systems (40 MGD)** (1) • 48" diameter pipeline, up to 19,000 feet.	Conceptual alignment along Willow Pass Road (Pittsburg Plant) or along Wilbur Ave and Lone Tree Way
Connection from EBMUD to Zone 7 (25 MGD Water Quality) (1) • Regulating Station and, 39" diameter pipeline, up to 40,000 feet.	Conceptual alignment from San Ramon Pressure Zone to north end of Zone 7's Treated Water Transmission System in Dublin.

(1) The RDP identified the pump station and pipelines as necessary facilities. Calculation of flow and head for pump station and pipeline lengths were completed as part of BAWQ&SRP and have not been evaluated by the RDP.



Legend

🟧 Potential Pipeline Alignment

CDM

Figure E4-2
Mirant Antioch or Pittsburg Desalination Regional View

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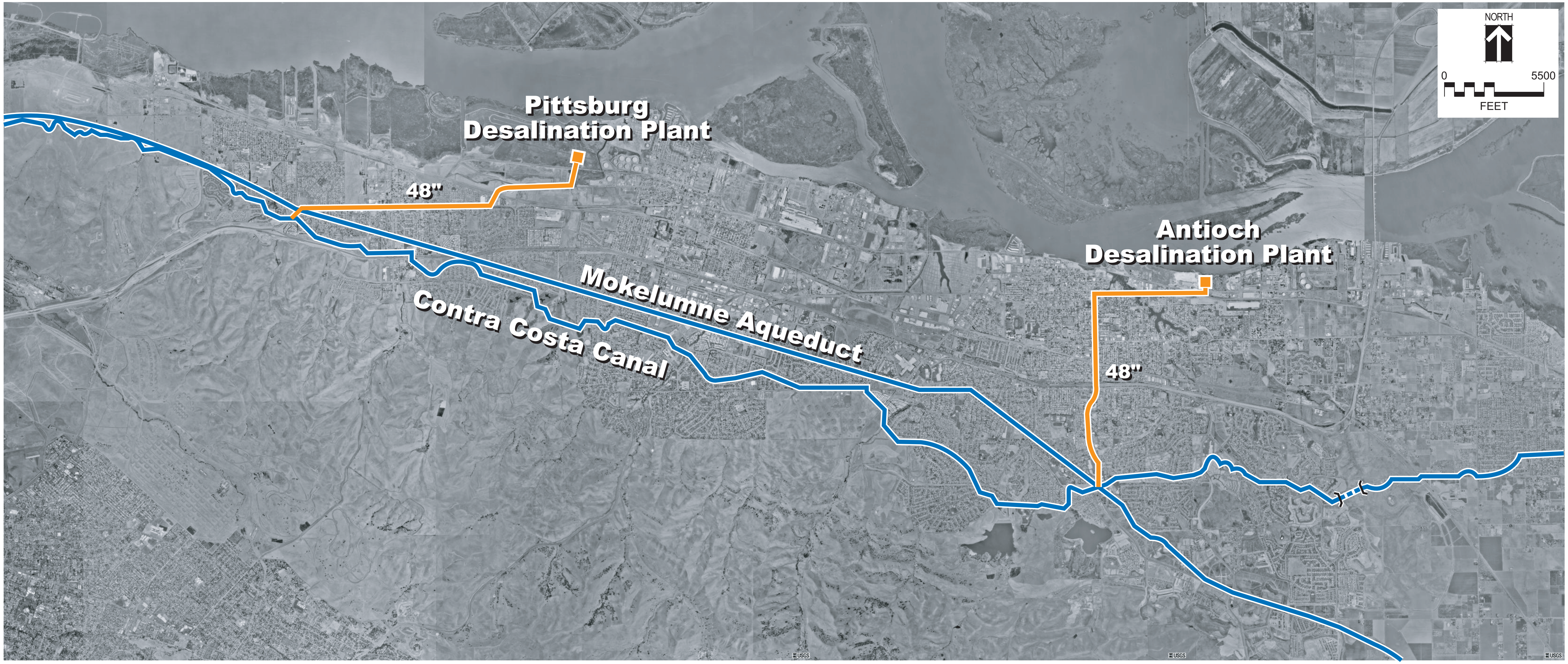


Legend

▬ Existing Pipelines

▬ Potential Pipeline Alignment

Figure E4-3

Mirant Antioch or Pittsburg Desalination

Potential Treated Water Connection to CCWD and EBMUD Systems

Basis for Facility Sizing

Concept-level pump station and pipeline sizing and pipeline alignment routing for connections to EBMUD, and CCWD were developed as part of separate evaluations. Concept-level alignments for pipelines are based on connections to facilities placed in existing surface streets.

Information for a potential intertie between EBMUD and Zone 7 systems is based on general information from EBMUD and Zone 7 systems.

3.2 Project Costs

Table E4-7 summarizes projected cost opinions for this concept.

Table E4-7
Mirant Pittsburg or Antioch Desalination with Water Quality Element
Estimated Project Costs(1) ($Million, 2003 dollars)

Capital Costs	
Desalination Plant On-site Facilities	$168.3
Treated Water PS and PL to EBMUD & CCWD	$TBD(2)
Interconnection EBMUD to Zone 7	$ TBD(2)
Environmental Mitigation	$5.2
Total Capital Cost	**$173.5**
Operating Costs	
Labor	$1.0/Year
Power	$8.3/Year
Chemicals, Membrane Replace, Misc. Maintenance	$7.4/Year
Total Operating Cost	**$16.7/Year**
Annual Costs	
Annualized Capital Costs	$12.0/Year
Operating Costs	$17.0/Year
Total Annual Cost	**$29.0/Year**

(1) Capital, Operating, and Annual Costs taken from RDP PFR, assuming 40 MGD treated water capacity, 95% plant factor, and operation in all years. Additional costs associated with exchange of water to indirect RDP recipients, as well as costs for conveyance to Zone 7, are not included in the above estimates.
(2) To be determined in future studies.

3.2.1 Basis for Cost Estimates

Capital Costs:

- Desalination Plant: Regional Desalination Study capital cost opinion plus environmental mitigation, $2003.

- Environmental Mitigation: Mitigation costs are assumed to include only the transmission and pumping facilities not already constructed as part of the RDP. Costs would be dependent on site-specific impacts and conditions set forth by the regulatory agencies, if any. In general, mitigation costs could range from one to five percent of the total capital costs.

- Operating Costs: Regional Desalination Study, $2003.

- Annual Costs: Regional Desalination Study. Includes annualized capital cost plus operating costs. Capital cost amortized assuming 5.5% for 30 years, $2003.

- Additional costs associated with exchange of water to indirect RDP recipient, as well as costs for conveyance to Zone 7, are projected, and are not included in the above estimates.

3.3 Outstanding Issues and Questions

- Public acceptance of desalinated supply.

4. Near Bay Bridge Desalination with Water Quality Element (20 MGD)

4.0 Concept Overview

4.0.1 Description

The Near Bay Bridge Desalination with Water Quality Element concept would involve the conveyance of water in average years to Zone 7 for water quality blending. This concept provides an incremental water quality benefit beyond the Regional Desalination Project. It assumes location of an up to 40 MGD desalination plant near the EBMUD Regional Wastewater Treatment Plant (WWTP), located in Oakland at the eastern end of the Bay Bridge, as described by the Regional Desalination Project. According to EBMUD, there is insufficient space at the WWTP for addition of a desalination facility. Implementation of this concept would require the acquisition of additional property from the Port of Oakland or at the former Oakland Army Base.

This concept is an extension of the project described in the Bay Area Regional Desalination Project Pre-Feasibility Study (RDP PFR, 2003). It has not been evaluated by the Regional Desalination Project.

In contrast to the regional study, which evaluated this concept principally for dry-year supply, this study is also evaluating this concept for potential to provide both drought supply reliability, and average year water quality benefits to agencies participating in the BAWQ&WSR Program that are not currently Regional Desalination Project partners. Zone 7 is a potential average year water quality partner.

4.0.2 Partners and Supply Amounts

Table E4-8 summarizes potential partners for the Near Bay Bridge with Water Quality Element desalination concept. Zone 7 Water Agency would potentially be interested in water for blending and/or for groundwater storage and subsequent extraction for drought supply.

Although other agencies were considered as potential project participants, water rights issues may require that agencies receiving project water must be physically capable of receiving water from the desalination facility, not through exchange of Mokelumne River water. Therefore, for this concept, only EBMUD and Zone 7 were considered as potential partners.

Water could be delivered through EBMUD's East of Hills (EOH) system, through a new interconnection sized to deliver up to 20 MGD to the Zone 7 system in lower demand months of average or wet years, when excess capacity is available in the EBMUD distribution system. Detailed hydraulic studies would be needed to determine what amount of capacity is available in EBMUD's West of Hills system after first meeting EBMUD's operational needs. The amount of water that could be conveyed to Zone 7 is likely less than 10 TAF/yr. Conceptual-level facilities and cost estimates for the concept are developed using information from the regional desalination study (RDP PFR, 2003) and from evaluation in this study of EBMUD and Zone 7 systems.

Table E4-8
Near Bay Bridge Desalination with Water Quality Element
Potential Partner and Supply Amounts

Agency	*Type of Benefit*	*Potential Amount (AFY)*	*Notes/Issues*
EBMUD	Dry-year supply (RDP)	TBD	The Near Bay Bridge facility will be sized to deliver up to 43,000 AFY. EBMUD could receive dry-year supply for its West of Hills (WOH) System. Specific plant locations, allocations or exchange with other partner agencies will be determined as part of the Regional Desalination Project. All RDP partners will benefit from the desalination facility in dry years. The quantity and operations will be determined in future phases of the RDP process.
CCWD	Dry-year supply (RDP)	TBD	
SFPUC⁽¹⁾	Dry-year supply (RDP)	TBD	
SCVWD	Dry-year supply (RDP)	TBD	
Zone 7 Water Agency	Average Year Water quality	Up to 10,000 AFY	Deliveries via new connection between EBMUD and Zone 7, for direct delivery for blending. Transfers are limited due to hydraulic capacity constraints from the West of Hills to the East of Hills system.

(1) For the purposes of this study, SFPUC includes retail customers and the 28 wholesale customers, BAWSCA member agencies.

Dry Year Supply

EBMUD is assumed to be a recipient of water for dry-year supply reliability from the base desalination facility that is part of the RDP. The total available dry-year supply for the concept is 43,000 AFY, based on a 40 MGD plant capacity, with the plant operated 95% of the time (RDP PFR, 2003). EBMUD would be principally interested in dry year supply, with up to the entire desalination treatment capacity of 40 MGD delivered.

Zone 7 would not receive any dry year supply.

Average Year Water Quality

Zone 7 is a potential participant for average year water quality supply. The total average–year supply available to Zone 7 would be 20 MGD. Construction of a new pumping plant of up to 20 MGD capacity (design criterion for west-to-east flow for Southern Loop Pipeline) would be required.

Other Partners Considered But Not Included

The following other potential partners were considered but not included.

Table E4-9
Near Bay Bridge Desalination with Water Quality Element
Other Partners Considered But Not Included

Agency	*Type of Benefit*	*Reason Not Included*
CCWD	Dry-year supply reliability, Average Year water quality	Unable to receive water other than through exchange of Mokelumne River water.
ACWD	Average Year water quality	Not interested in being considered as a project beneficiary independently from what they receive from the SFPUC regional system.
BAWSCA	Average Year water quality	Not interested in being considered as a project beneficiary independently from what they receive from the SFPUC regional system or SCVWD system.

4.0.3 Operating Description

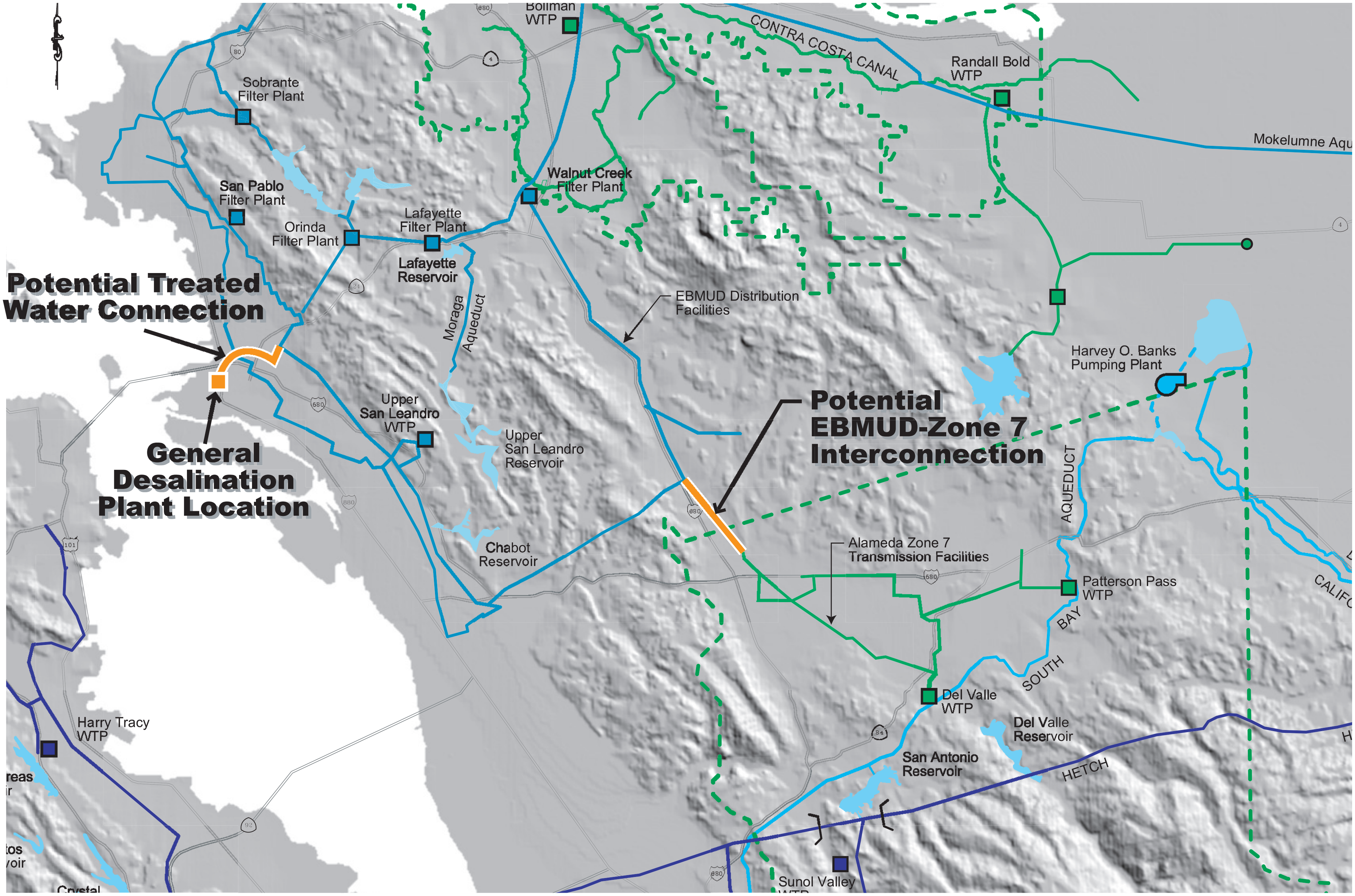
In dry years, desalinated water would be conveyed from the Near Bay Bridge desalination plant to EBMUD's Central Pressure Zone (15 MGD) and to the Sequoia Aqueduct (25 MGD). These approximate flow splits are based on demands in the Central Pressure zone and capacity of the Sequoia Aqueduct. Water delivered to the Sequoia Aqueduct would be delivered to the south and could be used to serve southern portions of Central zone, and pressure zones in Castro Valley.

Deliveries to Zone 7 would be from the Southern Loop through EBMUD's East of Hills (EOH) San Ramon Valley system, with a new interconnection sized to deliver up to 20 MGD to the Zone 7 system in lower demand months of average or wet years, when excess capacity is available in the EBMUD distribution system. Detailed hydraulic studies would be needed to determine what amount of capacity is available in EBMUD's West of Hills system after first meeting EBMUD's operational needs. The amount of water that could be conveyed to Zone 7 is likely less than 10 TAF/yr. West to east operation of the Southern Loop with current 7 MGD engine-driven pumps is not allowable because of pumping plant noise and air quality regulations. Construction of a new pumping plant of up to 20 MGD capacity (design criterion for west-to-east flow for Southern Loop Pipeline) or modification of existing pumping facilities would be required.

Zone 7 could use the water directly to blend with other supplies, or could potentially inject the water into its groundwater basin for subsequent extraction. Further study would be required to determine the feasibility of groundwater injection.

4.1 Project Facilities

Figures E4-4 and E4-5, and Table E4-10 summarize the proposed facilities for this concept.



Legend

▬ Potential Pipeline Alignment

CDM

Figure E4-4

Near Bay Bridge Desalination Regional View

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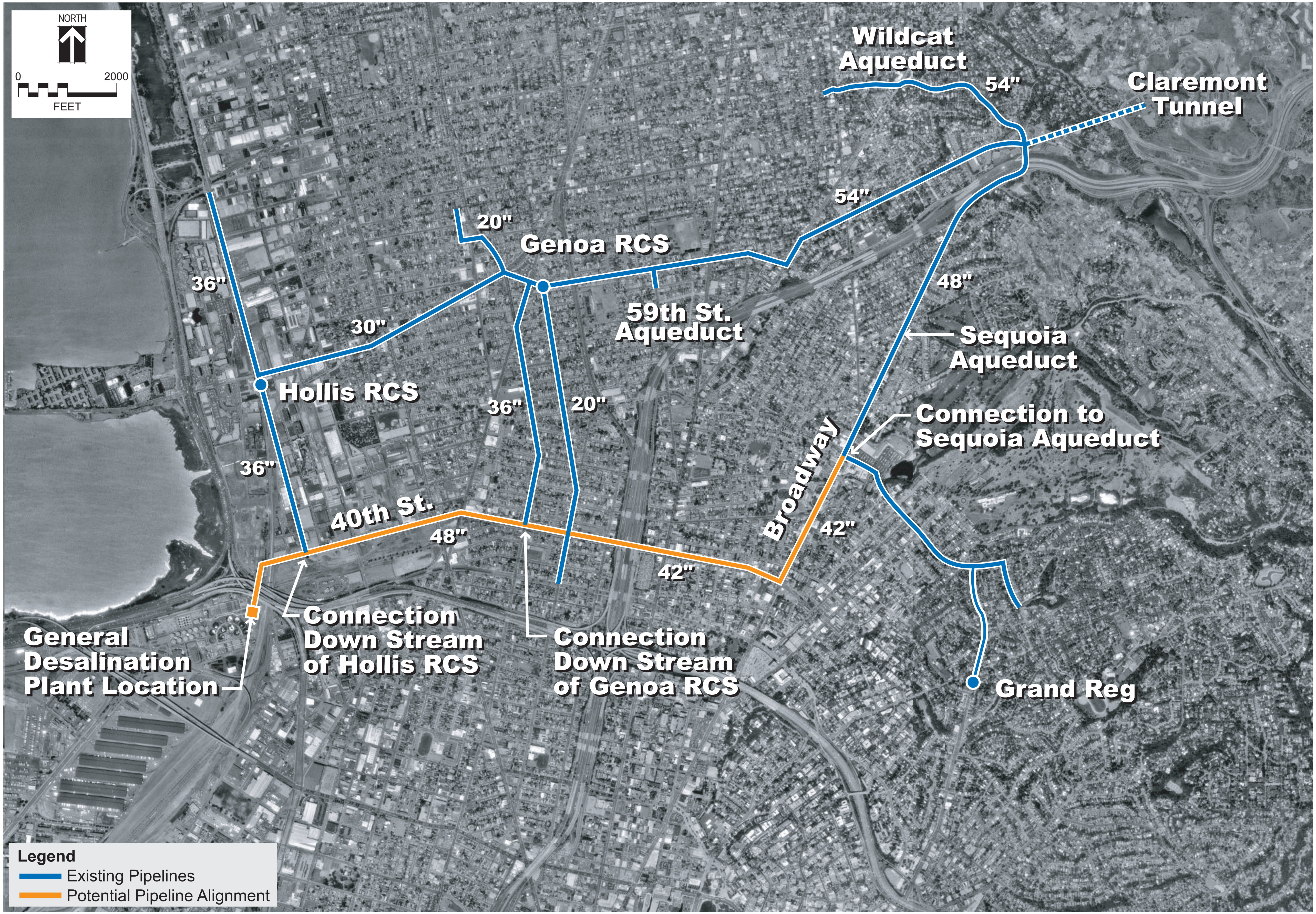

Figure E4-5

Near Bay Bridge Desalination

Potential Treated Water Connection to EBMUD System

Table E4-10
Near Bay Bridge with Water Quality Element
Project Facilities

Facility	Notes
Desalination Facility - RDP - 88 MGD intake (3 miles, 6' diameter) intake in San Francisco Bay - Pre- and post-treatment systems - 40 MGD reverse osmosis treatment - 48 MGD brine disposal via the treated wastewater outfall - Energy recovery device installed in plant	Two pass system with energy recovery, 200 mg/L TDS combined permeate, 300 mg/L product water after post-treatment.
Pump Stations[1] - Treated Water Pump Station (40 MGD, 360 feet total dynamic head) - New Southern Loop pump station (20 MGD, 580 feet total dynamic head)	- Lift based on Sequoia Aqueduct maximum gradient of 344 feet. - Lift based on anticipated Southern Loop pipeline operating conditions; west-to-east flow at 20 MGD
Pipelines[1] **From Plant to EBMUD system**[1] - 48" diameter pipeline, approximately 10,600 feet.	Conceptual alignment along 40th St, connecting downstream of Hollis and Genoa Rate Control Stations and along Broadway connecting to the Sequoia Aqueduct
Connection from EBMUD to Zone 7 (20 MGD Water Quality Benefit) - Regulating Station and 39" diameter pipeline, up to 40,000 feet.	Conceptual alignment from San Ramon Pressure Zone to north end of Zone 7's Treated Water Transmission System in Dublin.

[1] The RDP identified the pump station and pipelines as necessary facilities. Calculation of flow and head for pump station and pipeline lengths were completed as part of BAWQ&SRP and have not been evaluated by the RDP. All calculations associated with the connection to Zone 7 were developed as part of BAWQ&SRP and have not been evaluated by the RDP.

According to EBMUD, there is insufficient room at the wastewater treatment plant and property would need to be acquired for the desalination plant and appurtenant facilities. The wastewater treatment plant is adjacent to the former Oakland Army Base. The northern portion of the property was transferred to the Oakland Base Reuse Authority (Reuse Authority) and the southern portion to Oakland Port Authority (Port Authority) in late 2002. The Reuse Authority plans a mix of commercial and industrial uses. The Port Authority plans industrial uses. More information regarding the development of this land is provided in Section 8, Regulatory and Institutional Issues.

Basis for Facility Sizing

Concept-level pump station and pipeline sizing and pipeline alignment routing for connections to EBMUD were developed. Concept-level alignments assume pipelines are places in existing surface streets.

Information for a potential intertie between EBMUD and Zone 7 systems is based on general information from EBMUD and Zone 7 systems.

4.2 Project Costs

Table E4-1 summarizes project capital, operating and annualized costs.

Table E4-11
Near Bay Bridge Desalination with Water Quality Element
Estimated Project Costs(1) ($ Million, 2003 dollars)

Capital Costs	
Desalination Plant	$259.4
Treated Water PS and PL to EBMUD	$TBD
Interconnection EBMUD to Zone 7	$TBD
Environmental Mitigation	$8.0
Total Capital Cost	**$267.4**
Operating Costs	
Labor	$1.0/Year
Power	$21.1/Year
Chemicals, Membrane Replace, Misc. Maintenance	$12.3/Year
Total Operating Cost	**$34.4/Year**
Annual Costs	
Annualized Capital Costs	$18.4/Year
Operating Costs	$34.0/Year
Total Annual Cost	**$52.4/Year**

(1) Capital, Operating, and Annual Costs taken from RDP PFR, assuming 40 MGD treated water capacity, 95% plant factor, and operation in all years. Additional costs associated with exchange of water to indirect RDP recipients, as well as costs for conveyance to Zone 7, are not included in the above estimates.

4.2.1 Basis for Cost Estimates

Capital Costs:

- Desalination Plant: Regional Desalination Study capital cost opinion plus environmental mitigation, in $2003.
- Environmental Mitigation: Mitigation costs are assumed to include only the transmission and pumping facilities not already constructed as part of the RDP. Costs would be dependent on site-specific impacts and conditions set forth by the regulatory agencies, if any. In general, mitigation costs could range from one to five percent of the total capital costs.
- Operating Costs: Regional Desalination Study, $2003.
- Annual Costs: Regional Desalination Study. Includes annualized capital cost plus operating costs. Capital cost amortized assuming 5.5% for 30 years, $2003.
- Additional costs associated with exchange of water to indirect RDP recipients, as well as for interconnections with Zone 7, are projected, and are not included in the above estimates.

4.3 Outstanding Issues and Questions

- This option would likely not be pursued if the lower cost concept (Mirant Desalination with Water Quality Element) is viable. Subsequent phases of the RDP will determine which desalination facility or facilities are pursued.

- This analysis assumes construction of a 10,600 foot 48” diameter pipeline along Broadway. This is one possible route identified in this study, but may have significant institutional issues. The RDP will evaluate pipeline alignment alternatives in detail.

5. South Bay Desalination Concepts

5.0 Concept Overview

5.0.1 Description

The South Bay Desalination concept could involve construction of up to three desalination plants in Santa Clara County treating brackish groundwater extracted from the upper aquifer. The upper aquifer is currently only used for small local domestic or agricultural uses, or for chemical contamination remediation projects. Three potential sites have been identified: Pico Power Plant in Santa Clara, Los Esteros Power Plant in San Jose, and the Palo Alto Regional Water Quality Control plant (WQCP) in Palo Alto. Each of these plants is assumed to have a treated water production capacity of up to 4 million gallons per day (MGD)[6]. The end use for the desalinated supply could be for non-potable irrigation and industrial use, or for potable use. Two different target supply and water quality ranges have been selected, corresponding to the alternatives for end use. A feedwater capacity of 5 MGD per facility is assumed for potable supply. However, due to recycled water supplies available for irrigation and industrial uses, demand for these purposes is lower, and production capacity is assumed to be 1 MGD[7] per plant.

These concepts were evaluated in the regional desalination study (RDP PFR, 2003) that evaluated potential regional desalination plant sites to provide drought and emergency supply. The South Bay Desalination concepts received only a preliminary evaluation in the regional study and were not carried forward in the detailed cost and operational analysis because of their small capacity. The detail included in this analysis has not been evaluated by the RDP.

5.0.2 Potential Partners and Supply Amounts

Table E4-12 summarizes potential partners for a South Bay desalination concept.

Potential participants are the Cities of Palo Alto, Santa Clara, and San Jose, which are BAWSCA member agencies and SFPUC/SCVWD common customers. The total available dry-year supply for the concept is up to 13,800 AFY of potable water, or up to 3,200 AFY of non-potable water, based on three plants of 5 MGD intake water (potable) or 1 MGD production (irrigation/industrial) each, and with 80 percent recovery and plants operating 95 percent of the time. Potential estimates for each agency have been developed in the BAWQ&SR Program (CDM, 2004).

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[6] Plant capacity assumed to be 5 MGD. Treating influent brine at an 80% recovery ratio would yield 4 MGD product water.

[7] Plants would be sized to yield 1 MGD product water.

Table E4-12
South Bay Desalination
Potential Partner and Supply Amounts [(1)]

Agency	***Type of Benefit***	***Potential Amount (Acre-Feet/Year)***	***Notes/Issues***
City of Palo Alto (SCVWD, SFPUC[(2)], BAWSCA)	Dry Year Supply	Up to 4,600 AFY (potable) Up to 1,000 AFY (irrigation/industrial)	No average year water quality benefit because Palo Alto receives high quality SFPUC water.
	Average Year Water Quality	None	
City of Santa Clara (SCVWD, SFPUC[(2)], BAWSCA)	Dry Year Supply	Up to 4,600 AFY (potable) Up to 1,000 AFY (irrigation/industrial)	Average year water quality benefit likely only applies if desalinated water has a higher water quality than Santa Clara's groundwater or SCVWD supplies, and is cost-competitive.
	Average Year Water Quality	Up to 4,600 AFY (potable)	
San Jose Municipal Water System (SCVWD, SFPUC[(2)], BAWSCA)	Dry Year Supply	Up to 4,600 AFY (potable) (Up to 1,000 AFY irrigation/industrial)	Average year water quality benefit likely only applies if desalinated water has a higher water quality than SJMWS's groundwater supply and is cost-competitive.
	Average Year Water Quality	Up to 3,700 AFY	

(1) While the facility may be operated as a permanent supply source, only dry-year supply and average year water quality benefits are evaluated as part of this study.

(2) For the purposes of this study, SFPUC includes retail customers and the 28 wholesale customers, BAWSCA member agencies.

Palo Alto Regional WQCP Site

The City of Palo Alto (SFPUC/SCVWD common customer) purchased 15,000 AFY of water from SFPUC in fiscal year 2000/2001, or 99 percent of its supply. The city also has a small recycled water supply. (BAWUA, 2001).

The City of Palo Alto could potentially use up to 4,600 AFY of dry-year supply from a desalination plant to meet potable demands, or up to 1,000 AFY of non-potable dry-year supply to meet irrigation and/or industrial demands, freeing up SFPUC supply for delivery to SFPUC wholesale or retail customers if the supply is not needed to meet demand in the City of Palo Alto.

There would be no average year water quality benefit since SFPUC water is already high quality.

Pico Power Plant

The Pico Power Plant is located in the City of Santa Clara (SFPUC/SCVWD common customer). In fiscal year 2000/2001, the city purchased 4,500 AFY from SFPUC, 4,200 AFY from SCVWD. By 2020, the city projects purchase of 5,500 AFY from SFPUC and 4,300 AFY from SCVWD (BAWUA, 2001).

The City of Santa Clara could potentially use up to 4,600 AFY of dry-year supply to meet potable demands, or up to 1,000 AFY of non-potable dry-year supply to meet irrigation and/or industrial demands, freeing up either SCVWD or SFPUC water for delivery to SFPUC wholesale or retail customers if the supply is not needed to meet demand in the City of Santa Clara. The majority of the City of Santa Clara's supply is met from groundwater.

Although desalinated water could potentially be lower in TDS than current groundwater supplies or SCVWD supplies, this concept would likely only have an average year water quality benefit if desalination is cost-competitive with other supplies.

Los Esteros Power Plant

The Los Esteros Power Plant is located within the North San Jose/Alviso service area of the San Jose Municipal Water System (SJMWS). This portion of the SJMWS does not receive surface water deliveries from SCVWD (San Jose, 2001). In fiscal year 2000/2001 the City of San Jose purchased 5,400 AFY from SFPUC. Projected supply amounts in 2020 include 3,000 AFY from SFPUC, 3,700 AFY of groundwater and 2,300 AFY of recycled water (BAWUA, 2001).

The SJMWS could potentially use up to 4,600 AFY to meet potable demands, or up to 1,000 AFY of non-potable dry-year supply to meet irrigation and/or industrial demands. This could offset use of groundwater or SFPUC purchases, increasing local groundwater dry-year yields, or freeing up water for delivery to other SFPUC wholesale or retail customers if the supply is not needed to meet demand in SJMWS.

Although desalinated water would be lower in TDS than current groundwater supplies, this concept would likely only have an average year water quality benefit if desalination is cost-competitive with groundwater. Potential average year water supply is 3,700 AFY, based on SJMWS projections for year 2020 groundwater use.

Other Partners Considered But Not Included

This study assumes the product water from the South Bay desalination plant will only be used locally, and could potentially free up supply for delivery to SCVWD, SFPUC, or BAWSCA customers. No other agencies were considered as beneficiaries.

5.0.3 Operating Description

Conceptual-level facilities layouts would need to be developed for these projects as part of future studies. This section discusses general facilities required using preliminary information from the regional desalination study and from evaluation by the SCVWD, and Cities of Palo Alto, Santa Clara, and San Jose systems.

Groundwater extraction wells would be installed to supply the plant(s) with source water. Capacity at each site would be based on the production capacity of the upper aquifer. Little information exists, but the aquifer capacity is estimated to be less than 5 MGD at each site. (RDP PFR, 2003). For planning purposes, a maximum intake of 5

MGD was assumed for potable water production, and 1 MGD production capacity was assumed for irrigation/industrial supplies at each site. The plants have an assumed 80% recovery factor, i.e., approximately 4 MGD of product water would be produced for every 5 MGD of brackish groundwater pumped, depending upon the blending ratio required to meet the target finished water TDS goal (CDM, 2004).

The two power plant sites discharge blow-down water to the existing sanitary sewer system. Potential use of the sanitary sewer for brine disposal would need to be evaluated. The Palo Alto WQCP discharges its effluent to the San Francisco Bay. The desalination facility at this site could potentially mix its brine with the existing plant's effluent before discharge to the bay (RDP PFR, 2003).

Project water from the Palo Alto WQCP site could be conveyed into the City of Palo Alto's treated water system via new pipelines from the WQCP site. The extent of new facilities would need to be determined in future studies. The Pico Power Plant is located within the water distribution system served by groundwater (Santa Clara, 2004). Desalinated water from this facility could be conveyed into the water distribution system or possibly to areas of the city served by SCVWD treated surface water. Potential treated water pipeline alignments would need to be determined in future studies.

Desalinated water from the Los Esteros Power Plant site would be conveyed from the desalination plant directly into the SJMWS North San Jose/Alviso service area distribution system via new pipelines. Potential pipeline alignments would need to be determined in future studies.

Additional new distribution facilities, including pump stations and pipelines, would be required to convey non-potable supply to end users for irrigation and/or industrial purposes. Potential non-potable pump stations sizing and pipeline alignments would need to be determined in future studies.

Concept development assumed that water for potable purposes would be treated for two finished water targets: 40 mg/L total dissolved solids (TDS), based on matching the TDS of a SFPUC Hetch Hetchy/Sunol blend; and 280 mg/L TDS, based on matching SCVWD delivered water quality. Water for irrigation and/or industrial purposes would be treated for two finished water targets as well: 290 mg/L total dissolved solids (TDS), which is slightly greater than the average delivered water TDS concentration for Santa Clara county; and 500 mg/L, based on the secondary water quality standard for TDS in drinking water.

5.1 Project Facilities

Figure E4-6 and Table E4-13 summarize the proposed facilities for this concept.

Table E4-13
South Bay Desalination
Project Facilities

Facility	*Notes*
Desalination Facilities • Groundwater wells • 5-MGD pipelines from wells to desalination plant • Pre- and post-treatment systems • 3.3-4.9-MGD reverse osmosis treatment per facility (potable) • 0.4-0.7 MGD reverse osmosis treatment per facility (irrigation and industrial uses) • 0.7 – 1.0 -MGD brine disposal via power plant cooling water return or Bay discharge per facility (potable uses) • 0.2 MGD brine disposal via power plant cooling water return or Bay discharge (irrigation and industrial uses)	Single pass system with energy recovery, 14 milligrams per liter (mg/L) TDS RO water, 40-280 mg/L TDS finished water after blending (potable uses), and 290-500 mg/L TDS finished water after blending (irrigation and industrial uses). (ACWD, 2002)
Pump Station • To be determined in future studies	
Pipelines **From Pico Power Plant to SCVWD system** • To be determined in future studies **From Pico Power Plant to City of Santa Clara system** • To be determined in future studies **From Los Esteros Plant to SJMWS system** • To be determined in future studies	Substantial infrastructure may be required for conveyance of desalinated water to meet irrigation and/or industrial demands.

Basis for Facility Sizing

In the regional desalination study, conceptual facilities layouts were not prepared for the South Bay desalination plant sites. Concept-level facility layouts for connections to local systems will not be developed as part of this study, but would be developed in subsequent, more detailed studies.

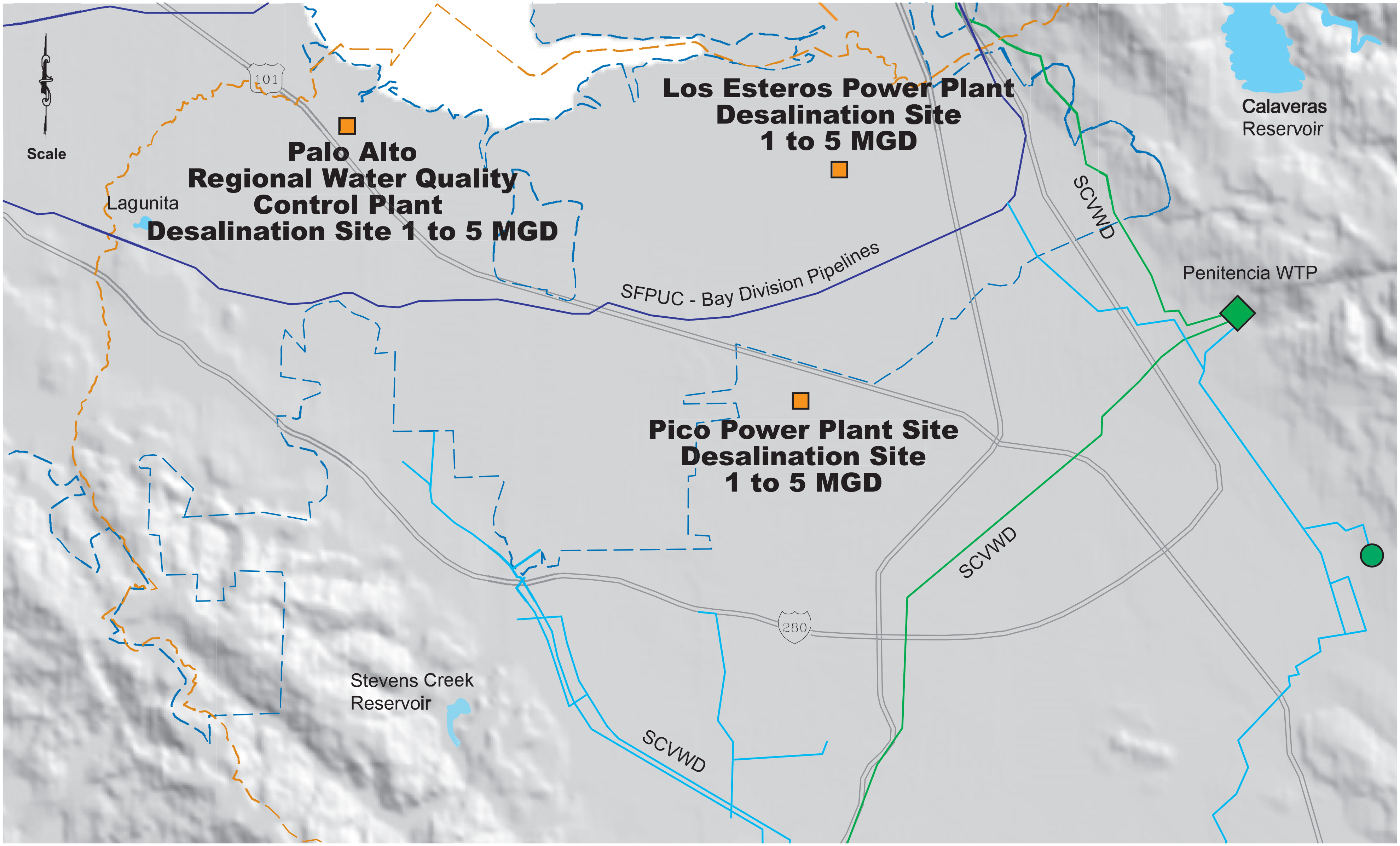

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Figure E4-6
South Bay Desalination Potential Site Locations

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5.2 Project Costs

Table E4-14 summarizes project capital, operating and annualized costs.

Table E4-14
South Bay Desalination
Estimated Project Costs (1) (2004 dollars)

Capital Costs	**Potable Use**	**Irrigation and/or Industrial Use**
Desalination Plants	$40 - $134 Million	$13 - $16 Million
Environmental Mitigation	$1.2-$4.1 Million	$0.4 – 0.5 Million
Total Capital Cost	$41 - $138 Million	$14 - $17 Million
Operating Costs		
Total Operating Cost	$ 8.8 - $9.5 Million /Yr	$ 2.6 Million /Yr
Annual Costs		
Annualized Capital Costs	$ 3.0 - $10.0 Million/Yr	$ 1.0 - $1.2 Million/Yr
Operating Costs	$ 8.8 - $9.5 Million /Yr	$ 2.6 M/Yr
Total Annual Cost	$ 12 - $19 Million/Yr	$ 3.6 – 3.8 Million/Yr
Unit Costs		
Total Unit Cost	$ 900 - $1,400/AF	$ 1,100/AF

(1) Costs assume total available dry-year supply for the concept is up to 13,800 AFY of potable water, or up to 3,200 AFY of non-potable water, based on three plants of 5 MGD intake water (potable) or 1 MGD production (irrigation/industrial) each, and with 80 percent recovery and plants operating 95 percent of the time. Annualized costs assume 30 years at 6 percent.

5.2.1 Basis for Cost Estimates

Capital Costs:

- Desalination Plant: Assumes $1.50/gallon of permeate for potable RO process elements, $1.50/gallon of production for ancillary facilities for potable water production, plus 30 percent contingency. Assumes $2.00/gallon of permeate for non-potable RO process elements, $2.50/gallon of production for ancillary facilities for non-potable water production, and $0.50/gallon of production for additional infrastructure required for conveyance of desalinated water for irrigation and/or industrial purposes, plus 30 percent contingency[8].

- Environmental Mitigation: Assumed to be 3% of total project capital costs. Costs would be dependent on site-specific impacts and conditions set forth by the regulatory agencies, if any. For the 0.3 MGD Marina Coast desalination plant, mitigation costs amounted to less than three percent of the total costs (Youngblood, 2004). It is anticipated that mitigation costs would be less than the RDP where water would be taken directly from surface water sources.

- Operating Costs: Assumes $500/AFY of production, plus 30 percent contingency.

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[8] Economy of scale is reduced for smaller, non-potable facilities (i.e., 4 MGD potable production vs. 1 MGD non-potable production per facility). As a result, cost factors have been increased accordingly. In addition, substantial infrastructure may be required for conveyance of non-potable desalinated supply to end users for irrigation and industrial use. For the purposes of this study, $0.50/gal was assumed for construction of these facilities. This number will depend on the extent of additional infrastructure required, which is unknown at this time.

- Annual Costs: Assumes six percent over 30 years.

5.3 Outstanding Issues and Questions

- Availability of groundwater
- Mitigation of brine
- Public acceptance

6. East Bay Saline Groundwater Desalination Concept

6.0 Concept Overview

6.0.1 Description

The East Bay Saline Groundwater Desalination Facility would involve location of a 10 to 15 MGD (treated production capacity) desalination plant in Newark or Fremont, California, for the purpose of desalinating non-potable, saline groundwater from the saline portion of the Newark Aquifer.

Water would be extracted through a series of bayshore perimeter wells within Alameda County Water District's service area. Finished water could be pumped directly into ACWD's distribution system or into San Francisco Public Utilities Commission's (SFPUC's) Bay Division Pipelines 1& 2 in its regional transmission system. Concentrate discharge could potentially be disposed of by delivering it to the East Bay Discharge Authority (EBDA) discharge pipeline, several miles north of the project area, or other options to be identified and evaluated during project planning.

6.0.2 Potential Partners and Supply Amounts

Table E4-15 summarizes potential partners for the East Bay Saline Groundwater Desalination Facility concept. ACWD would potentially be interested in this concept for dry year supply and/or for average year water quality. SFPUC and BAWSCA would potentially be interested in dry year supply. SCVWD has expressed interest in potentially partnering in this project. Details of SCVWD participation will be developed in future studies.

Table E4-15
East Bay Saline Groundwater Desalination
Potential Partner and Supply Amounts

Partner	*Type of Benefit*	*Potential Amount (AFY)*	*Notes/Issues*
SFPUC[1]	Dry-year supply	Up to 16,000 AFY	Deliveries via the Bay Division Pipelines 1&2.
BAWSCA	Dry-year supply	Up to 16,000 AFY	Deliveries via SFPUC regional system.
ACWD	Dry-year supply	Up to 16,000 AFY	Deliveries via direct connection to ACWD facilities or through exchange with SFPUC.
	Average Year Water quality	Up to 16,000 AFY	
SCVWD	Dry-year supply	Up to 16,000 AFY	To be determined in future studies.
	Average Year Water quality	Up to 16,000 AFY	

(1) For the purposes of this study, SFPUC includes retail customers and the 28 wholesale customers, BAWSCA member agencies.

Dry Year Supply

SFPUC, BAWSCA, ACWD and SCVWD would potentially be interested in dry year and emergency supplies. All three agencies are seeking dry-year supply to meet current and future needs. Potential high-end dry-year supply amounts were estimated based on producing 15 MGD year-round (17,000 AFY), with a 95% plant factor (e.g. plant is operational 95% of the time, and unavailable due to maintenance or other reasons 5% of the time), for an annual total production of 16,000 AFY.

Average Year Water Quality

ACWD and SCVWD could potentially be interested in average year water for water quality. Options for ACWD might include blending desalination water with well water, using desalinated water in lieu of groundwater, or using desalinated water in conjunction with surface and imported supplies for groundwater basin management, to reduce salinities in the up-gradient potable portion of the Newark Aquifer. Potential average year water quality supply amounts have been estimated based on producing up to 15 MGD year-round (17,000 AFY) , with a 95% plant factor (16,000 AFY).

Other Partners Considered But Not Included

No other potential partners were considered for this concept.

6.0.3 Operating Description

The desalination concept would extract and treat non-potable, saline water from the saline portion of the Newark Aquifer adjacent to the San Francisco Bay. Water would be extracted through a series of bay shore perimeter wells within ACWD's District Boundary. Finished water could be pumped directly into ACWD's distribution system and/or into SFPUC's Bay Division Pipelines 1&2. Concentrate discharge could potentially be disposed of using the East Bay Discharge Authority (EBDA) discharge line, several miles north of the project location, or other options to be identified and evaluated during the project planning phase.[9]

Specific concept configurations and delivery amounts will need to be developed as part of future studies. This section discusses potential delivery options that may be considered as this project is further developed. Depending on the project configuration, a number of delivery and exchange operational scenarios are possible. Example options include:

- Dry-year delivery to ACWD system, in conjunction with ACWD reducing dry-year SFPUC contract deliveries to free up SFPUC supply for delivery to wholesale or retail customers;

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[9] EBDA has not been contacted to determine the feasibility of using their outfall facilities for brine disposal.

- Dry-year delivery to SFPUC's Bay Division Pipelines 1 & 2 for distribution to wholesale customers, increasing supply reliability to the SFPUC regional system customers including ACWD.
- Dry-year deliveries to both SFPUC's Bay Division Pipelines and ACWD system.
- Average year deliveries to ACWD to blend with local groundwater supplies. This would allow ACWD to reduce purchases from SFPUC in average years and would free up use of SFPUC water for other purposes.
- Average year deliveries to ACWD, in conjunction with imported and local surface water deliveries, for groundwater management.

The extent to which each of these options may be feasible will depend on a variety of institutional and technical issues that would need to be evaluated as part of project development.

6.1 Project Facilities

Figure E4-7 shows a general location map for the desalination concept, showing locations of existing facilities in ACWD system. Although no specific site has been identified for the desalination facility, siting considerations would include proximity to:

- SFPUC Bay Division Pipelines 1 & 2;
- ACWD treated water distribution pipelines;
- ACWD blending facility, where groundwater and SFPUC supplies are currently blended;
- SFPUC hydropower transmission lines that terminate at Newark substation, possibly allowing power to be provided at wholesale utility rates.

Figure E4-8 shows a schematic cross-section of the Niles Cone groundwater basin, showing the general location for the desalination extraction wells, in the western portion of the Newark aquifer (left side of figure). ACWD actively manages the entire basin, with recharge facilities and two major wellfields in the eastern portion. In addition, Aquifer Reclamation (ARP) Program Wells draw water from the central portions of the Newark, Centerville and Fremont Aquifer to reduce salinity in these portions of the basin, caused by historic seawater intrusion. Water from some of these wells is treated at a small desalination facility that delivers water directly to the ACWD distribution system.

The proposed location for East Bay Saline Groundwater Desalination extraction wells is the western edge of the Newark Aquifer, where TDS levels are relatively high, around 25,000 mg/l. In this area, the aquifer is confined, relatively thin, and the formation is principally sand and gravel with high hydraulic conductivity. Because this area is hydraulically part of the Niles Cone which is actively managed and used for groundwater supply, a key issue would be determining what extraction rates may be feasible in order to ensure compatibility with ACWD's aquifer reclamation efforts and inland groundwater production and recharge operations.

The desalination facility would use reverse osmosis treatment. Concept development assumed that water would be treated for a finished water goal of 40 mg/L total dissolved solids (TDS), based on matching the TDS of a SFPUC Hetch Hetchy/Sunol blend. This would require a two-pass treatment process. A plant producing 15 MGD would require an intake of 25 MGD, and would generate 10 MGD of brine.

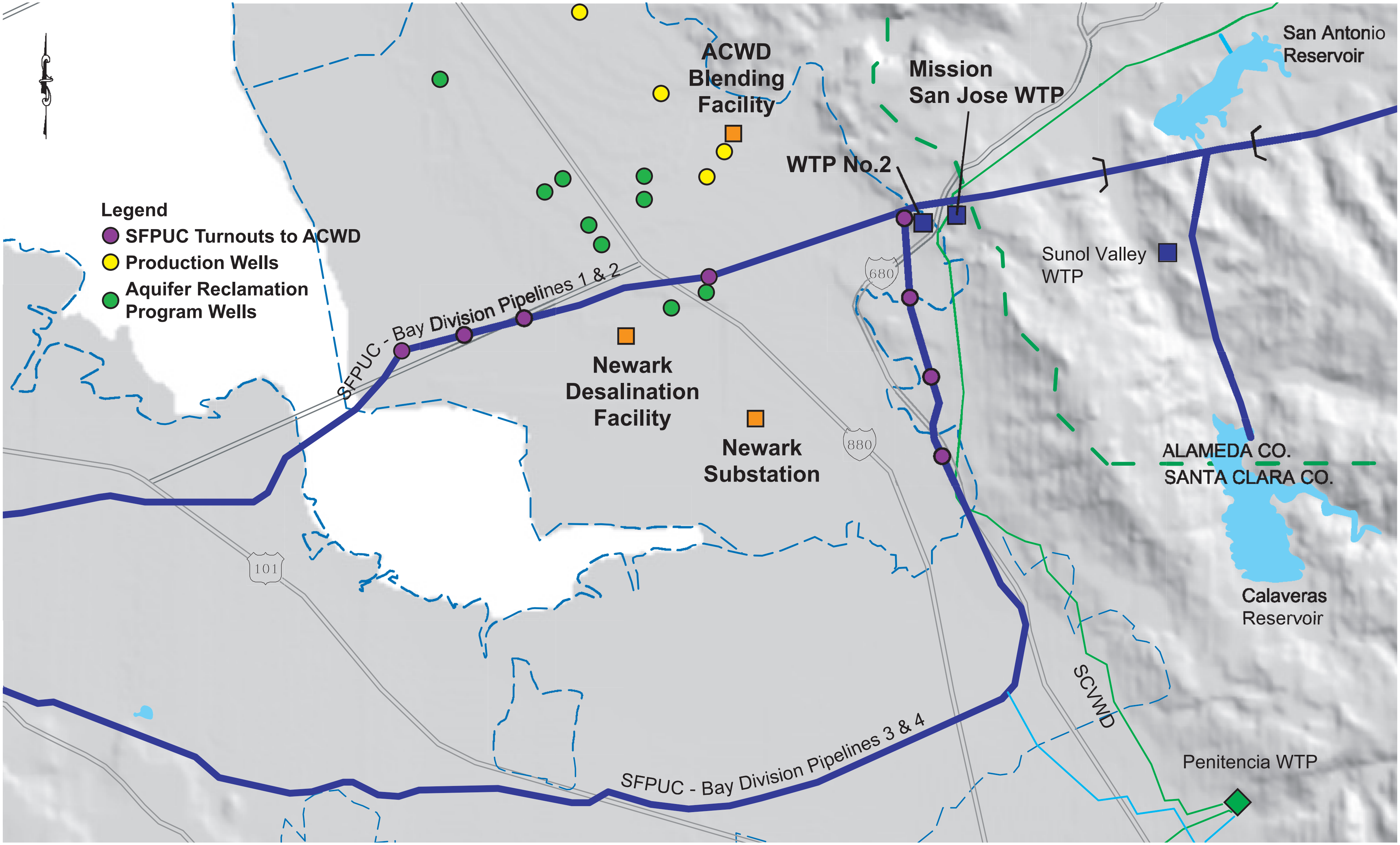

Figure E4-7
East Bay Saline Groundwater Desalination - General Area Map

CDM

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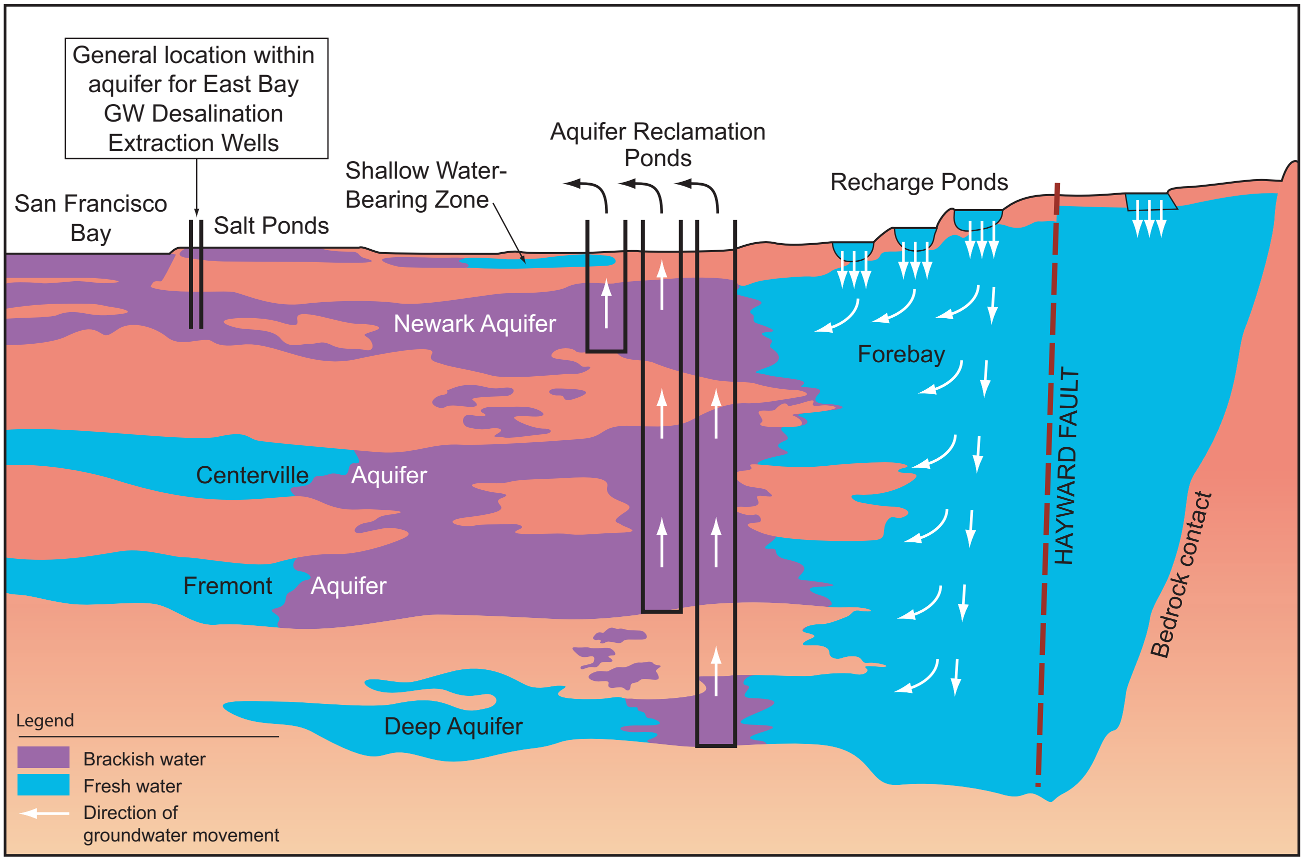

Figure E4-8

Niles Cone Groundwater Basin Schematic

Table E4-16 summarizes the potential facilities for this concept.

Table E4-16
East Bay Saline Groundwater Desalination
Potential Project Facilities

Facility	***Notes***
Desalination Facility	
• Bayshore wells • Raw water pipeline to desalination plant • Reverse osmosis treatment plant (Up to 15 MGD product water) • Brine disposal pipeline • Connection to existing power transmission	Wells in saline portion of Newark Aquifer. ACWD estimates 10 to 15 MGD capacity Possible connection to EBDA transmission system. Potential for use of Hetch Hetchy power
Conveyance Facilities	
• Treated Water Pump Station • Connection to BDPL1&2 or ACWD system	

Basis for Facility Sizing

Desalination plant treated water capacity is estimated at 10 to 15 MGD. Specific sizing and locations of project facilities will need to be evaluated during project planning.

6.2 Project Costs

Table E4-17 summarizes estimated costs for this concept.

Table E4-17
East Bay Saline Groundwater Desalination Facility
Estimated Project Costs ($Million, 2004 dollars)

Capital Costs	
Desalination Plant On-Site Facilities	$ 75 Million
Raw Water Conveyance Facilities	$To be determined in future studies
Treated Water Conveyance Facilities	$To be determined in future studies
Brine Disposal	$To be determined in future studies
Environmental Mitigation	$To be determined in future studies
Total Capital Cost	$To be determined in future studies
Operating Costs	
Total Operating Cost	$ 10 Million/Year
Annual Costs	
Annualized Capital Costs	$ 5.4M for plant only
Operating Costs	$ 10M for plant only
Total Annual Cost	$ TBD in future studies

6.2.1 Basis for Cost Estimates

Basis for Cost Estimates

Capital Costs:

- Desalination Plant: $75 million (25 MGD intake, two pass, 15 MGD treated water at 40 mg/L) capital cost, estimated in 2004 dollars.

- Operating Costs: $1800/MG for two pass system, for plant operating costs only.

- Annualized capital cost: 6% interest rate over 30 years.

Unit cost for capital and operating cost of desalination facility only is $960/AF, assuming operation in all years at a 95% plant factor. This unit cost does not include capital or O&M costs for intake wells, treated water pipelines, brine discharge lines.

6.3 Outstanding Issues and Questions

The following items are outstanding issues and questions that will need to be addressed as part of future studies.

- Planning-level studies are needed to determine alternative plant locations and sizes, and locations of raw and treated water conveyance facilities.

- Feasibility studies would need to be conducted to determine what, if any, interactions exist with the potable portions of the Niles Cone groundwater basin, and what extraction rates would be feasible without compromising potable supply.

- Brine disposal options will need to be evaluated during a planning phase for this concept. Possible options that ACWD may wish to consider include:

  - Use of the EBDA outfall. The existing EBDA pipeline is several miles north of the project area. Availability of capacity, as well as EBDA's willingness to accept brine would need to be evaluated.

  - Use of the Union Sanitary District force main in Newark. Availability of capacity in the force main, as well as USD's willingness to accept brine would need to be evaluated. Union Sanitary District treats effluent at the Alvarado Wastewater Treatment Plant. The plant discharges to San Francisco Bay via Hayward Marsh, which is managed by the Hayward Area Recreation and Park District. Both the treatment plant and the marsh may be sensitive receptors for brine.

  - Use of the former Irvington or Newark wastewater treatment plant outfalls, if still intact and not plugged. These plants were de-commissioned in 1981.

  - Blending with San Jose/Santa Clara Water Pollution Control Plant discharge. The plant discharges to Artesian Slough. The plant has summertime flow restrictions because of low salinity of discharge water.

  - If SCVWD is interested in participating in this concept, details of their participation would need to be developed in future studies.

7. Engineering Analysis

This section contains an engineering analysis for aspects of the project that will be assessed in the detailed concept and portfolio evaluation (the "scorecard").

7.1 System Vulnerability

7.1.1 Regional Desalination Project

The alternatives presented in the Regional Desalination Project would provide varying levels of protection from system vulnerability, depending on their location. System vulnerability is defined as susceptibility of facilities to damage or failure from catastrophic events, such as earthquakes. In addition, exchanges resulting from the RDP could impact system vulnerability. This information will be developed in later stages of the RDP.

If implemented as part of the RDP, the Mirant Desalination facility would reduce vulnerability for the EBMUD and CCWD systems. For EBMUD this concept would provide additional reliability in the case of full or partial loss of the Mokelumne supply or Mokelumne Aqueducts. It would not provide against loss due to a seismic event on either the Hayward or Calaveras faults. CCWD would realize increased reliability by providing an additional supply downstream of the Delta sources. As a treated water supply it could also replace a portion of the capacity of the Randall Bold or Bollman Water Treatment Plants if they were out-of-service.

If implemented by the RDP, the Near Bay Bridge Desalination facility would also reduce vulnerability for the EBMUD system. The proposed facility would likely be located in EBMUD's distribution system, and would reduce EBMUD's vulnerability to catastrophes such as earthquakes. EBMUD's principal supply to the WOH system is from the Orinda WTP, conveyed through the Claremont Tunnel, which crosses the Hayward fault. The District is currently implementing a program to seismically reinforce the Claremont Tunnel. Implementation of the Near Bay Bridge Desalination concept would reduce system vulnerability by providing a ready source of high quality water.

Vulnerability benefits to SCVWD and SFPUC resulting from implementation of RDP facilities will be determined as part of the RDP.

7.1.2 Mirant Pittsburg or Antioch Desalination with Water Quality Element

This concept would provide Zone 7 with increased reliability in the event of South Bay Aqueduct supply interruption, during winter months of in normal and wet years only.

7.1.3 Near Bay Bridge Desalination with Water Quality Element

This concept would provide Zone 7 with increased reliability in the event of South Bay Aqueduct supply interruption, during winter months of normal and wet years only.

7.1.4 South Bay Desalination

The South Bay Desalination concept would reduce vulnerability for the SFPUC/SCVWD common customers. The potable supply concept would provide some local supply if SFPUC facilities were damaged during an earthquake and could not provide water.

In addition, desalinated water would add a new source of supply and add to the variety of sources of supply for the residents and businesses in Santa Clara County.

7.2 Supply Reliability

7.2.1 Regional Desalination Project

The Regional Desalination Project concept would provide improved supply reliability to all Regional Desalination partners. All partners would receive supply from this project, either directly from the desalination facility, or through exchanges with agencies receiving desalinated supplies directly. This information will be further developed in later stages of the RDP.

If implemented as part of the RDP, the Mirant Desalination facility would provide 43,000 AFY of supply reliability for CCWD, EBMUD, SCVWD and SFPUC. Supply reliability benefits to each agency would depend on allocation of this dry-year supply, to be determined as part of the RDP.

If implemented as part of the RDP, the Near Bay Bridge Desalination facility would provide 43,000 AFY of dry year supply. Supply reliability benefits to each agency would depend on allocation of this dry-year supply, to be determined as part of the RDP

7.2.2 Mirant Pittsburg or Antioch Desalination with Water Quality Element

This concept would not provide additional dry year supply to any agencies beyond that being received as part of the base RDP facility. As such, no additional dry year supply reliability benefit would be achieved through implementation of this concept.

7.2.3 Near Bay Bridge Desalination with Water Quality Element

This concept would not provide additional dry year supply to any agencies beyond that being received as part of the base RDP facility. As such, no additional dry year supply reliability benefit would be achieved through implementation of this concept.

7.2.4 South Bay Desalination

The South Bay Desalination concepts would provide water supply all years as well as dry year supply directly to SFPUC/SCVWD common customers and could potentially free up water for delivery to other SFPUC wholesale customers, SCVWD customers, or BAWSCA member agencies, or reduce groundwater use. This supply would also be in local control and not subject to the types of uncertainties associated with imported water.

7.3 Water Quality

The desalination concepts would provide improved water quality over the Delta supply, though likely not as high quality as Sierra supplies. Depending upon the facility(ies) implemented and the mechanisms used to convey water to the partners, potential water quality benefits and impacts will vary.

7.3.1 Regional Desalination Concept

Water quality is not a performance criterion for the RDP.

7.3.2 Mirant Pittsburg or Antioch Desalination with Water Quality Element

The desalination facilities will provide improved water quality over the Delta supply. However, CCWD and EBMUD currently have different source water qualities, and treated water goals. The treated water goals will affect the treatment levels required, including:

- Whether treatment identified in Regional Study is appropriate to meet the agency water quality goals, or whether additional treatment is required. The plant described in the RDP has a permeate TDS concentration of 150 mg/L, which is poorer water quality than typical EBMUD supplies. Important analytical issues in determining if the treated water goal is met or not will be any blending of desalinated water with Mokelumne supplies and treating desalinated water again at EBMUD's WTPs. For the purposes of this analysis, EBMUD has indicated they would accept water containing TDS concentrations similar to those observed at Freeport in average years. This water would then be blended with Mokelumne Aqueduct water. The average long term TDS for Freeport, based on Greene's Landing water quality monitoring data is approximately 101 mg/L. The RDP assumed an addition of 50 mg/L TDS resulting from post-processing. As such, a target TDS of 50 mg/L was used in this study, for a finished water TDS of 100 mg/L.

- If the desalinated water is introduced into the treated water systems (e.g. CCWD Multi-Purpose Pipeline) the potential for increased production of bromate due to the higher bromide levels is insignificant. However, for the purposes of this study, it has been assumed that the desalinated water is introduced into the raw water system, resulting in the potential for increased bromate production.

- Bromide levels in the desalinated water effluent are projected to be comparable to those found in Zone 7's sources (0.26 mg/L (Krasner et. al, 1994)) in desalinated water compared to Zone 7's average dry year bromide levels of <0.38 mg/L).

7.3.3 Near Bay Bridge Desalination with Water Quality Element

Again, effluent bromide remains a potential concern associated with desalination facilities. Bromide levels in the desalinated water are expected to be higher than historical levels in the EBMUD system (0.34 mg/L (Krasner et. al, 1994)) in desalinated water compared to EBMUD average dry year bromide levels of <0.01 mg/L). Bromide can be converted to bromate after treatment with ozone. Since the

Near Bay Bridge facility would disinfect with chloramine and discharge finished water directly into EBMUD's treated water distribution system, desalinated water would not come into contact with ozone. As a result, the water quality concern of increased bromate resulting from higher influent bromide values would not be a significant concern**.** Another concern is the potential slow oxidation of bromide by chloramine in the distribution system and its impacts of chloramine residual stability. This will be especially significant for EBMUD and SFPUC. Presence of elevated bromide levels would also be expected to increase the fraction of brominated disinfection by-products, which may lead to regulatory concerns in the future.

As with the Mirant Desalination with Water Quality Element concept, the Zone 7 connection would be to the treated water system, so bromate production would not be a concern. Moreover, bromide levels in the desalinated water effluent are comparable to those found in Zone 7's sources (0.34 mg/L [Krasner et. al, 1994] in desalinated water compared to Zone 7's average dry year bromide levels of approximately 0.38 mg/L), and would not be expected to significantly increase the bromide concentration of Zone 7 finished water.

To minimize the effect of blending higher TDS desalinated water with EBMUD supplies, a target TDS of 50 mg/L was selected. The RDP assumed an addition of 100 mg/L TDS resulting from post-processing. As such, a finished water TDS of 150 mg/L was achieved.

7.3.4 South Bay Desalination

The typical low-pressure RO process rejects 98 percent of the dissolved minerals in the water resulting in a low TDS permeate for a brackish groundwater. CDM estimates the TDS concentration of RO permeate from the SCVWD brackish wells will be less than 50 mg/L with a hardness level less than 10 mg/L. This water is corrosive and is typically blended with a small percentage of high TDS groundwater and adjusted to a pH of 8.0 to 8.5 to stabilize the water. For planning purposes, it is assumed that the bypass stream would range from 3 to 100 percent of the RO process water, depending upon finished water quality targets, and the finished water hardness would be raised to 130 mg/L.

Concept development assumed that water for potable purposes would be treated to two finished water targets: 40 mg/L total dissolved solids (TDS), based on matching the TDS of a SFPUC Hetch Hetchy/Sunol blend; and 280 mg/L TDS, based on matching SCVWD delivered water quality. Water for irrigation and/or industrial purposes would be treated for two finished water targets as well: 290 mg/L total dissolved solids (TDS), which is slightly greater than the average delivered water TDS concentration for Santa Clara county; and 500 mg/L, based on the secondary water quality standard for TDS in drinking water.

A single pass desalination facility would produce permeate water at a TDS of 14 mg/L, which would be blended with groundwater to achieve a combined TDS ranging from 36 to 275 mg/L for potable purposes, and 286 to 496 mg/L for irrigation and industrial purposes. An additional 4 mg/L of TDS would be added as a result of post-processing. Depending upon target end use, TDS levels would range from 40 to 280 mg/L (potable), or 290 to 500 mg/L (irrigation or industrial). Groundwater used for blending may need to be treated for other constituents prior to blending (ACWD, 2002). CDM developed this information based on experience with the ACWD Brackish Water Desalination Plant in Newark, California.

In average years, the City of Santa Clara, and the City of San Jose could potentially use desalinated water for water quality blending. The lower TOC and TDS of the desalinated water would be expected to improve these agencies' raw water quality, resulting in improved taste and odor and reduced disinfection byproducts. However, desalination would likely need to be cost-competitive with other supplies for implementation to occur.

7.3.5 Emerging Issues

Algal Toxins

Algal toxins present an emerging issue. In freshwater, toxins associated with blue-green algae have had significant impacts on cattle in other countries. In addition to their short-term effects, there is evidence that they may be potent liver carcinogens. Some of these toxins include Microcystin, Cylindrospermopsin, and Anatoxin. The World Health Organization has set a 1 µg/l guideline for microcystin-LR. However, some Japanese researchers have suggested, based on their work in China, that the guideline level should be 100 times lower. Little work on quantification has been done in North America. From a treatment perspective, while chlorine is effective for a few of these toxins, ozone is very effective in oxidizing most of these toxins. Of importance for desalination facilities are toxins associated with seawater (e.g., domoic acid, okadaic acid, and saxitoxin). For example, in 1998, a red algae bloom occurred in Monterey Bay. Four hundred California sea lions died from domoic acid neurotoxicity as a result of that bloom. These issues are of regulatory concern for desalination plants.

8. Environmental Analysis

This section summarizes the environmental analysis for the desalination concepts under the general environmental categories that will be presented in the detailed concept and portfolio evaluation (the "scorecard").

A comprehensive environmental summary is included as Appendix A. Information in this section is developed from review of documents by the California Coastal Commission (CCC, 2003, 2004), URS and Boyle (2003) and the Desalination Task Force (DTC, 2003), as well as knowledge of similar projects.

8.1 Potential Environmental Benefits

Environmental benefits are defined as an overall improvement to some aspect of environmental quality, to the land, air, or water. The benefits to specific concepts are described below.

8.1.1 Regional Desalination Project

This information will be developed in later stages of the RDP.

8.1.2 Mirant Pittsburg or Antioch Desalination with Water Quality Element

If use of this supply source by Zone 7 during normal years reduces spring pumping from the Delta, there would be environmental benefits to the Delta. An enforceable agreement with the Environmental Water Account (EWA) or alternate entities would be required to achieve these benefits. In the absence of an agreement the water may be delivered to another SWP contractor. It is assumed that this is an additional supply during dry years, and would not reduce Delta pumping by CCWD. Desalinated water would be expensive compared to other alternatives available to the EWA.

8.1.3 Near Bay Bridge Desalination with Water Quality Element

If use of this supply source by Zone 7 during normal years reduces spring pumping from the Delta, there would be potential environmental benefits to the Delta. Again, an enforceable agreement would be required to achieve these benefits. or the forgone water would likely be delivered to another SWP contractor. Again, desalinated water would likely be expensive compared to other alternatives available to EWA.

8.1.4 South Bay Desalination

If use of this supply source (Santa Clara – Pico Power Plant Site only) to offset SCVWD demands during normal years reduces spring and summer pumping from the Delta, there would be a benefit to the Delta. It is assumed that during dry years this would be an additional supply. No incremental benefits to the environment are anticipated from implementation if the concepts are located at the other sites.

8.1.5 East Bay Saline Groundwater Desalination

Implementation of this concept would slightly reduce pumping from the Delta, and thus would be considered an environmental benefit to Delta resources.

8.2 Potential Environmental Impacts

Environmental impacts are defined as potential degradation in the quality of the environment that will likely require mitigation. Table E4-18 summarizes potential environmental impacts for the project, identifying the issue area, potential impacts and mitigation opportunities for aquatic resources, terrestrial resources, wetlands and energy consumption. Other potential environmental impacts, including but not limited to land use and construction-related effects, are discussed in Appendix A.

Table E4-18
Summary of Potential Environmental Impacts
Desalination Concepts

Issue Area	***Potential Impacts***	***Mitigation Opportunities***
Aquatic Resources	**RDP – Mirant Pittsburg Desalination and Near Bay Bridge Desalination** Impacts to aquatic resources, including fisheries (steelhead, winter and spring-run Chinook salmon, coho salmon, and Pacific herring in the Bay or Ocean, and Delta smelt and Sacramento splittail in the Delta), from construction of the intake and operation of the Desalination facility (i.e., entrainment and impingement from use of the raw water intake line or effects from discharge of brine). Impacts to aquatic resources from construction of the intake (RDP)	Conduct relevant studies (i.e. models) on the effects of impingement and entrainment and discharge of brine on aquatic resources (DTC, 2003). Design new intake with state-of-the-art screens (EDAW, 2004). Redesign existing intake (for facilities co-located with power plants) with state-of-the-art screens (EDAW, 2004) or consider alternative intake locations (CCC, 2003). Brine discharge must be in compliance with Basin Plan and NPDES water quality standards. Acquire permits and comply with their conditions for construction activities within the affected water body. Segregate chemical waste stream from the brine.
	Mirant Pittsburg or Antioch Desalination with Water Quality Element and Near Bay Bridge Desalination with Water Quality Element Potential effects to aquatic resources from raw water intake (e.g., entrainment and impingement) are not anticipated as the amount of water withdrawn into the plant would constitute a small percentage of overall flow during the average and wet years and the intake would be already equipped with state-of-the-art screens.	None anticipated.
	RDP - Oceanside Potential to affect resources within the Gulf of Farallones National Marine Sanctuary.	Consider beach wells instead of an intake in the ocean to reduce impingement / entrainment. Also, see RDP discussion above for other mitigation opportunities to reduce potential effects to aquatic resources.

Table E4-18
Summary of Potential Environmental Impacts
Desalination Concepts

Issue Area	*Potential Impacts*	*Mitigation Opportunities*
	General – Brine Discharge via the WWTP Discharge of brine via an existing wastewater treatment plant (joint use of the wastewater outfall) would reduce potential adverse effects on aquatic resources by assuring continuous mixing and dilution of the brine with wastewater effluent prior to discharge into the Ocean / Bay / Creek, and would increase the discharge to a salinity level closer to that of receiving water. Potential impacts may occur during drought events when there may be insufficient effluent to dilute the brine. Release of the combined effluent without proper dilution would affect Ocean / Bay / Creek resources (RDP PFR, 2003, EDAW, 2004). Diurnal fluctuations may cause problems, especially for small plants.	Construction of equalization ponds to store wastewater and / or brine to ensure proper mixing of the two effluents prior to discharge into surface waters (EDAW, 2004). Brine discharge must be in compliance with Basin Plan and NPDES water quality standards.
	South Bay Desalination and East Bay Saline Groundwater Desalination Use of groundwater rather than other surface water sources could reduce adverse effects to aquatic resources (from operation) (EDAW, 2004).	None required
	General – Brine discharge via the Power Plant Combining the brine from the desalination process with discharge from the power plant would reduce potential adverse effects on aquatic resources in the following manner: (1) increase the mixing and dilution of the brine prior to discharge into surface waters, when both the desalination facility and the power plant are jointly operated; and (2) eliminate the need to construct an intake in the open water (EDAW, 2004).	Brine discharge must be in compliance with Basin Plan and NPDES water quality standards.

Table E4-18
Summary of Potential Environmental Impacts
Desalination Concepts

Issue Area	*Potential Impacts*	*Mitigation Opportunities*
Aquatic Resources (cont'd)	**RDP - Mirant Pittsburg Desalination, Co-location with Power Plant** Co-locating with a power plant would reduce potential adverse effects on aquatic resources in the following manner: (1) increase the mixing and dilution of the brine prior to discharge into surface waters, when both the desalination facility and the power plant are jointly operated; and (2) eliminate the need to construct an intake in the open water (EDAW, 2004). Although the California Coastal Commission (CCC) recognizes that co-location would not increase entrainment beyond what was already caused by the power plant if they are operated in coordination, it recommends an analysis assuming an independent location because entrainment rates associated with existing intake could be high (CCC, 2003). Information on the existing entrainment rates is not available for the Mirant power plants. Assuming that the power plant was temporarily or permanently shut down, operations of the desalination facility alone may result in impacts to aquatic resources, including: • Potential for fish kill as independent operation would require use of existing intake that may not be equipped with state-of-the-art screens (CCC, 2003); • Discharge of brine into the Delta without mixing with cooling water effluent – increased salinity may harm aquatic resources and exceed NPDES limits (EDAW, 2004)	In accordance with the final rule published by the U.S. EPA on July 9, 2004, existing power plants must minimize the number of aquatic organisms lost resulting from intake of water, through the use of best available technology (BAT). Participating agencies may share the costs of preparing a 316(b) study (to determine entrainment impacts) and / or implementing BAT jointly with the owners of the power plant, dependent on the timing of the study and improvements relative to the development of the desalination plant (EDAW, 2004). Re-design intake with state-of-the-art screens (EDAW, 2004) or consider alternative intake location (CCC, 2003).
	General Desalination - Transmission pipelines, pump stations, and other appurtenant facilities Construction of transmission pipelines, pump stations, and other facilities would result in minimal effects to the aquatic environment associated with stormwater runoff to nearby creeks and drainages.	Implement erosion and sediment control best management practices (BMPs) to prevent discharges into adjacent water bodies.
Terrestrial Resources	**General Desalination** No effects to sensitive habitats habitats if facilities are located within existing disturbed properties (e.g., power plants, Water Quality Control Plant [WQCP], roadways, etc.). Potential impacts to sensitive resources if facilities are located in or adjacent to riparian / tidal / open space areas, or other sensitive habitats (EDAW, 2004).	Further studies on a case-by-case basis to identify the type and amount of habitats and species affected. If avoidance of sensitive biological resources is infeasible, then minimize impacts through alternative siting, special construction techniques or restriction on construction schedule. Other measures include: implement standard BMPs, consult with regulatory agencies; conduct habitat assessments, and sensitive species / preconstruction surveys; acquire relevant permits and comply with permit conditions (EDAW, 2004).

Table E4-18
Summary of Potential Environmental Impacts
Desalination Concepts

Issue Area	***Potential Impacts***	***Mitigation Opportunities***
Wetland Resources	**General Desalination** No effects to wetlands resources if facilities are located within existing, disturbed properties (i.e., power plants, Water Quality Control Plant [WQCP], roadways, etc.). Potential impacts to wetlands resources if facilities are located within these areas (EDAW, 2004).	Further studies on a case-by-case basis to identify the type and amount of wetlands and associated species affected. If avoidance of these resources is infeasible, then minimize impacts through alternative siting, special construction techniques, or restriction on construction schedule. Other measures include: implement standard BMPs, consult with regulatory agencies; conduct habitat assessments, wetland delineations, and sensitive species/preconstruction surveys; acquire relevant permits and comply with permit conditions, replacement at 3:1 ratio (actual ratio determined by negotiations with regulatory agencies), monitoring (EDAW, 2004).
	RDP – Near Bay Bridge Site Depending on the location of concept facilities, potential for adverse effects to salt marshes, salt marsh harvest mouse, clapper rail, and other sensitive wetland resources.	
Energy	**General Desalination** RDP – Mirant Pittsburg Desalination Concept: 40 MGD plant: 104 million kwh; 120 MGD plant: 346 million kwh RDP - Near Bay Bridge Desalination Concept: 263 million kwh (CDM, 2004). RDP - Oceanside: 305 million kwh (CDM, 2004). Mirant Pittsburg or Antioch Desalination Concept with Water Quality Element and Near Bay Bridge Desalination with Water Quality Element- Actual energy consumption not known, but would be associated with additional operation of the plat, as well as pipeline and pump station operations. South Bay Desalination Concepts: 3,250 kwh/mg (CDM, 2004).	Energy recovery devices, installed as part of concept development, would reduce overall energy consumption. Enroll in a voluntary PG&E Demand Response Program to reduce demand on the electrical system during peak consumption periods
	Desalination – Co-location with Power Plant Where co-location would occur at power plants, the power plant could supply energy to the desalination facility, thereby reducing the need to increase transmission capacity elsewhere on the energy grid. However, this may have an effect on local or regional electric demand (CCC, 2003). If the power plant shuts down, no electricity would be available to run the desalination facility.	Provision of an alternative energy source if electricity from the existing power plant is not available.

9. Regulatory and Institutional Analysis

This section summarizes the regulatory and institutional evaluation for this concept for the general categories that will be assessed in the detailed concept and portfolio evaluation (the "scorecard").

9.1 Permitting

9.1.1 General

Permits from and consultation with regulatory agencies are required for the construction and operation of proposed facilities (i.e., desalination plant, pump station, transmission pipelines, etc.) where adverse environmental effects would occur. The permitting process must precede construction and operation of the facilities to ensure that potential adverse effects to sensitive resources are adequately addressed and commitments to protect, restore, enhance, or create affected resources are clearly outlined.

In general, the timeline and cost for permitting would depend on the number of permits and consultation required (based on the potential for adverse effects to sensitive habitats and associated special-status species), the duration to conduct necessary studies mandated by the agencies (i.e., entrainment studies), and the agencies themselves.

For the City of Santa Barbara and Marina Coast Water District, the permitting process for their desalination facilities took 1 and 1.5 years, respectively (Ferguson, 2004; Youngblood, 2004). However, as these facilities were implemented in the mid 1990s when the concept of desalination facilities for domestic water supply was relatively new in California, and operational effects on marine resources were not well understood, there were fewer regulations guiding such facility development. In addition, the Santa Barbara facility was developed during a water emergency, and therefore had the benefit of that status to move the project forward.

CEQA/NEPA documentation would be required in addition to permit acquisition. This process would take several years. Both the permitting and CEQA / NEPA processes may occur in parallel, but would require that adequate engineering and design details be developed for submission to regulatory agencies. Combining the processes would reduce the duration of the overall process, although the precise timeframe cannot be determined at this time.

For a list of general permitting and consultation requirements, refer to Appendix A. Permits unique to each desalination concept are discussed below.

9.1.2 Regional Desalination Project

Mirant Site

As discussed in the Bay Area Regional Desalination Pre-Feasibility Report (October, 2003), "Given the limited availability of Delta water due to prior rights issued and the large number of applications in queue, obtaining a water right permit for a proposed desalination project in the Delta would likely face challenges. However, if the applicant's appropriation is demonstrated to be in the public interest, and unappropriated water is available to supply the project, other considerations may be overridden by the SWRCB" (RDP PFR, 2003).

Because the Delta is already a source of supply, the watershed sanitary survey generally required by the Department of Health and Safety (DHS) for implementation of desalination facilities would likely not apply to this facility.

Entrainment studies may be required by the Bay Conservation and Development Commission (BCDC) even if the proposed plant would be located outside BCDC's jurisdiction, but additional raw water would be withdrawn from the power plant's existing infrastructure (intake and outfall). The potential partners may be involved in conducting entrainment studies.

EPA published its final rule establishing requirements for cooling water intake structures at Phase II existing power plants on July 9, 2004 (EPA, 2004). The rule establishes national performance standard requirements and procedures for implementing those requirements, applicable to the location, design, construction, and capacity of cooling water intake structures. The intent of the rule is to reduce aquatic organisms lost from intake structures. The rule generally requires that impingement mortality be reduced by 80 to 95 percent and if applicable, entrainment by 60 to 90 percent, using the best technology available. This may mean that the owners of the Mirant power plant would be required to conduct relevant study(ies) and to implement best available technology if the power plant meets the criteria of "existing facility," as defined by the final rule (e.g., if the power plant was constructed prior to January 7, 2002 and has a total design flow of 50 mgd). Participating agencies of the desalination plant may have to share the costs of entrainment studies and intake improvements of the power plant if a desalination facility is located at one of the Mirant power plant sites, depending on the timing of the required study.

Because the desalination facility would be co-located with an existing power plant, discharge requirements of the existing power plant NPDES would likely be applicable, and no new permits would be anticipated. Amendment to the existing permit would be required if the existing NPDES discharge prohibitions, effluent limitations, and receiving water limitations cannot be met.

Near Bay Bridge Site

To meet the regulations of the Surface Water Treatment Rule, Department of Health and Safety (DHS) typically requires a watershed sanitary survey for implementation of desalination facilities. This may be required for development of a desalination plant that withdraws water from the San Francisco Bay.

In addition to DHS requirements, BCDC requirements are also relevant for desalination plant development within the San Francisco Bay. BCDC is responsible for the administration of the Coastal Zone Management Act within San Francisco Bay. BCDC published an independent staff report on the Commission's policies regarding desalination in October 2004. This report (*Desalination and San Francisco Bay*) describes the current desalination technologies and operation, current planning proposals for desalination facilities in the Bay Area, and environmental issues and concerns from desalination facility development. In addition, it recommends an amendment to the San Francisco Bay Plan to incorporate new findings concerning desalination facilities. Policy changes are related to the protection of aquatic and terrestrial organisms through adequate design of intake and plant facilities and compliance with discharge requirements. Although no specific requirements for entrainment studies were identified in the recommended policy changes, BCDC would likely require entrainment / impingement studies, as well as additional studies that identify other potential impacts from surface water intake and discharge of concentrate (Blanchfield, 2004). The timeline associated with relevant studies has not been specified.

Because the desalination facility would be co-located with an existing WWTP, discharge requirements of the existing WWTP NPDES would likely be applicable, and no new permits would be anticipated. Amendment to the existing permit would be required if the existing NPDES discharge prohibitions, effluent limitations, and receiving water limitations cannot be met.

Oceanside Site

Implementation of the Oceanside Site would require a watershed sanitary survey, in accordance with DHS regulations. Because the watershed for this facility is the Pacific Ocean, the RDP partner agencies would need to work with DHS to identify, to the extent possible, specific potential contaminant sources that affect ocean water quality, and to pinpoint the information (either from existing data or through additional studies) that would be necessary to characterize the conditions of the watershed.

In addition, the Coastal Commission requires a 316(b)-like study to determine potential impingement and entrainment impacts to aquatic resources associated with intake of seawater. The 316(b)-like study, may last up to three years, depending on Coastal Commission requirements.

9.1.3 Mirant Pittsburg or Antioch Desalination with Water Quality Element

This concept assumes that the RDP facility has been constructed. Operation of the plant during average and wet years would be unlikely to require additional permits. However, regulatory agencies with jurisdiction over the concept could require that any previous studies conducted for the RDP be updated to account for operational changes, to ensure that there would not be adverse effects to aquatic resources.

9.1.4 Near Bay Bridge Desalination with Water Quality Element

This concept assumes that the RDP facility has been constructed. Operation of the plant during average and wet years would unlikely necessitate additional permits. However, regulatory agencies with jurisdiction over the concept could require that any previous studies conducted for the RDP be updated to account for operational changes, to ensure that there would not be adverse effects to aquatic resources.

9.1.5 South Bay Desalination Concept

Because the desalination facilities would be co-located with existing Water Quality Control Plant (WQCP) or power plants, discharge requirements of the existing NPDES would likely be applicable, and no new permits would be anticipated. Amendment to the existing permit would be required if the existing NPDES discharge prohibitions, effluent limitations, and receiving water limitations cannot be met.

9.1.6 East Bay Saline Groundwater Desalination Facility Concept

Brine could possibly be discharged into the East Bay Discharge Authority (EBDA) discharge line. Discharge requirements of the existing NPDES would likely be applicable, and no new permits would be anticipated. Amendment to the existing permit would be required if the existing NPDES discharge prohibitions, effluent limitations, and receiving water limitations cannot be met.

9.2 Institutional Issues

9.2.1 General

The amount of public scrutiny associated with construction of a large desalination facility (RDP) and operational changes in the existing desalination (concepts with Water Quality Element) is unknown. The details of the concepts and accompanying mitigation / enhancement measures will be important considerations for public reviewers.

9.2.2 Regional Desalination Project - General

Currently, a four party partnership consisting of CCWD, EBMUD, SCVWD and SFPUC is carrying out pre-feasibility level analysis for a regional desalination project. The issue of whether to expand the partnership or not, or whether to allow others to use RDP facilities has not yet been addressed. Joint agreements and/or the formation of a new entity (JPA) would be needed to develop, fund, and operate a large, jointly owned project, including any ancillary infrastructure to distribute surrogate or exchange water to the beneficiaries, and to effect the equitable distribution of benefits. This information will be developed further in later stages of the RDP.

9.2.3 Mirant Pittsburg Desalination

The desalination facility would be located at one of the existing power plants. A leasing agreement between the participating agencies and the power plant owner to develop on private property would occur prior to the development of the project. Additional agreements may be required if electricity is purchased directly from the power plant.

9.2.4 Near Bay Bridge Desalination

The desalination facility may be located within private property or the former Oakland Army Base, which was transferred to the Oakland Base Reuse Authority in 2002. Development of the former Oakland Army Base would be conducted by the City of Oakland Development Agency and the Port. The redevelopment agency would develop the Gateway Development Area (GDA). The GDA area is reserved generally for development of high-end commercial and light industrial uses. In addition, a 15-acre spit of land will be transferred to the Department of Interior for development by the East Bay Regional Park District (EBRPD) as a regional shoreline park (Gateway Regional Park) alongside the eastern touchdown of the Bay Bridge. The park will provide waterfront access, open space, and wildlife habitat, as well as add to the visually-pleasing entrance to the East Bay. A segment of the San Francisco Bay Trail would also be installed to link the park to the trail along the Emeryville shoreline (to the north) and eventually to the Oakland waterfront (to the south). If the desalination facility is located at this site, an addition of a public facility may conflict with the envisioned land uses, as well as adversely affect the intended aesthetically-pleasing visual character of the redeveloped area.

The Port side is intended to provide maritime uses. Originally, the entire base was designated as a port priority use in the San Francisco Bay Plan and the San Francisco Bay Area Seaport Plan. Because of the conflict between the BCDC plans and the Draft Reuse Plan, the reuse program was reconfigured in a manner that "(1) assured BCDC that adequate acreage will be devoted to meeting container through-put forecasts for the Year 2020, and (2) reserved remaining Oakland Army Base property for other economic development uses" (OBRA, 2004). As a result, BCDC amended its plans to "remove the port priority use area and the maritime terminal designations from areas that would be developed by the ORA [Oakland Redevelopment Agency]" (OBRA, 2004).

Because of the reduction in acreage dedicated to maritime-related uses, remaining land would be valuable for such purposes, and there may not be excess space in the port area to allow for other industrial or public facility developments, such as a desalination facility.

If the desalination facility is located within the reuse area, an agreement and/or lease between participating agencies and the City of Oakland would be required for development of the plant.

9.2.5 Mirant Pittsburg or Antioch Desalination with Water Quality Element

The RDP participating agencies (CCWD, EBMUD, SCVWD, and SFPUC) and Zone 7 would be required to prepare and adopt a joint agreement outlining individual agencies' responsibilities to construct intertie facilities, operate the desalination during wet and normal years, and to effect the equitable distribution of benefits. The institutional and operations agreement would include, but not be limited to, discussions of the quantity of water allocated to each party, and the timing when such deliveries would occur.

9.2.6 Mirant Pittsburg or Antioch Desalination with Water Quality Element

The RDP participating agencies (CCWD, EBMUD, SCVWD, and SFPUC) and Zone 7 would be required to prepare and adopt a joint agreement outlining individual agencies' responsibilities to construct intertie facilities, operate the desalination during wet and normal years, and to effect the equitable distribution of benefits. The institutional and operations agreement would include, but not be limited to, discussions of the quantity of water allocated to each party, and the timing when such deliveries would occur.

9.2.7 South Bay Desalination Concept

The potential participating agencies (SCVWD, SFPUC, and BAWSCA) would be required to prepare and adopt joint agreements (and/or create a joint entity) outlining individual agencies' commitment to develop, fund (capital costs, operations and maintenance costs), and operate the project, including ancillary infrastructure to distribute surrogate or exchange water to the beneficiaries, and to effect the equitable distribution of benefits. The institutional and operations agreement would include, but not be limited to, discussions of quantities of SFPUC and SCVWD supplies being displaced to other types of use within Santa Clara County, individual agencies' responsibilities for operation of the joint facility, the quantity of water allocated to each party, and the timing when such deliveries would occur.

9.2.8 East Bay Saline Groundwater Desalination

The participating agencies (SFPUC, BAWSCA, and ACWD) would be required to prepare and adopt a joint agreement outlining the individual agencies' commitment to develop, fund (capital costs, operations and maintenance costs), and operate the project, including ancillary infrastructure to distribute surrogate or exchange water to beneficiaries, and to effect the equitable distribution of benefits. The institutional and operations agreement would include, but not be limited to, individual agencies' responsibilities for operation of the joint facility, the quantity of water allocated to each party, and the timing when such deliveries would occur.

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Appendix E4.A

Summary of Environmental Analysis – Desalination Concepts

Table E4.A-1
Potential Environmental Impacts and Mitigation Opportunities
Desalination Concepts

Issue Area	***Potential Effects***	***Mitigation Opportunities***
Feedwater Quality / (Product Water Quality Public Health)	**General Surface Water Desalination** Product water quality could be affected by contaminated source water. Water quality concerns include wastewater discharges, emerging and trace contaminants [endocrine disruptors and algal toxins]), and existing contaminants at the bottom of the water body in close proximity to the intake location (RDP PFR, 2003; DTC, 2003).	Conduct studies of the source water (i.e., DHS's required sanitary survey or equivalent) to assess the potential for impacts and mitigation needs (EDAW, 2004).
	General Desalination Potential impacts associated with the product water: Compatibility of the product water with the blended water; taste and odor of product water; and corrosivity of product water on pipes.	Meet DHS water quality standards and those of participating water agencies; two-pass reverse osmosis; post-treatment (lime).
Aquatic Resources	**RDP – Mirant Pittsburg Desalination and Near Bay Bridge Desalination** Impacts to aquatic resources, including fisheries (steelhead, winter and spring-run Chinook salmon, coho salmon, and Pacific herring in the Bay or Ocean, and Delta smelt and Sacramento splittail[1] in the Delta), from construction of the intake and operation of the Desalination facility (i.e., entrainment and impingement from use of the raw water intake line or effects from discharge of brine). Impacts to aquatic resources from construction of the intake (RDP)	Conduct relevant studies (i.e. models) on the effects of impingement and entrainment and discharge of brine on aquatic resources (DTC, 2003). Design new intake with state-of-the-art screens (EDAW, 2004). Redesign existing intake (for facilities co-located with power plants) with state-of-the-art screens (EDAW, 2004) or consider alternative intake locations (CCC, 2003). Brine discharge must be in compliance with Basin Plan and NPDES water quality standards. Acquire permits and comply with their conditions for construction activities within the affected water body. Segregate chemical waste stream from the brine.
	Mirant Pittsburg or Antioch Desalination with Water Quality Element and Near Bay Bridge Desalination with Water Quality Element Potential effects to aquatic resources from raw water intake (e.g., entrainment and impingement) are not anticipated as the amount of water withdrawn into the plant would constitute a small percentage of overall flow during the average and wet years and the intake would be already equipped with state-of-the-art screens.	None anticipated.

Table E4.A-1
Potential Environmental Impacts and Mitigation Opportunities
Desalination Concepts

Issue Area	***Potential Effects***	***Mitigation Opportunities***
	RDP - Oceanside Potential to affect resources within the Gulf of Farallones National Marine Sanctuary.	Consider beach wells instead of an intake in the ocean to reduce impingement / entrainment. Also, see RDP discussion above for other mitigation opportunities to reduce potential effects to aquatic resources.
Aquatic Resources (cont'd)	**General – Brine Discharge via the WWTP** Discharge of brine via an existing wastewater treatment plant (joint use of the wastewater outfall) would reduce potential adverse effects on aquatic resources by assuring continuous mixing and dilution of the brine with wastewater effluent prior to discharge into the Ocean / Bay / Creek, and would increase the discharge to a salinity level closer to that of receiving water. Potential impacts may occur during drought events when there may be insufficient effluent to dilute the brine. Release of the combined effluent without proper dilution would affect Ocean / Bay / Creek resources (RDP PFR, 2003, EDAW, 2004).	Construction of equalization ponds to store wastewater and / or brine to ensure proper mixing of the two effluents prior to discharge into surface waters (EDAW, 2004). Brine discharge must be in compliance with Basin Plan and NPDES water quality standards.
	South Bay Desalination and East Bay Saline Groundwater Desalination Use of groundwater rather than other surface water sources would avoid adverse effects to aquatic resources(from operation) (EDAW, 2004).	None required
	General – Brine discharge via the Power Plant Combining the brine from the desalination process with discharge from the power plant would reduce potential adverse effects on aquatic resources in the following manner: (1) increase the mixing and dilution of the brine prior to discharge into surface waters, when both the desalination facility and the power plant are jointly operated; and (2) eliminate the need to construct an intake in the open water (EDAW, 2004).	Brine discharge must be in compliance with Basin Plan and NPDES water quality standards.

Table E4.A-1
Potential Environmental Impacts and Mitigation Opportunities
Desalination Concepts

Issue Area	*Potential Effects*	*Mitigation Opportunities*
	Mirant Pittsburg Desalination, Co-location with Power Plant Co-locating with a power plant would reduce potential adverse effects on aquatic resources in the following manner: (1) increase the mixing and dilution of the brine prior to discharge into surface waters, when both the desalination facility and the power plant are jointly operated; and (2) eliminate the need to construct an intake in the open water (EDAW, 2004). Although CCC recognizes that co-location would not increase entrainment beyond what was already caused by the power plant if they are operated in coordination, it recommends an analysis assuming an independent location because entrainment rates associated with existing intake could be high (CCC, 2003). Information on the existing entrainment rates is not available for the Mirant power plants.. Assuming that the power plant was temporarily or permanently shut down, operations of the desalination facility alone may result in impacts to aquatic resources, including: • Potential for fish kill as independent operation would require use of existing intake that may not be equipped with state-of-the-art screens (CCC, 2003); • Discharge of brine into the Delta without mixing with cooling water effluent – increased salinity may harm aquatic resources and exceed NPDES limits (EDAW, 2004)	In accordance with the final rule published by the U.S. EPA on July 9, 2004, existing power plants must minimize the number of aquatic organisms lost resulting from intake of water, through the use of best available technology (BAT). Participating agencies may share the costs of preparing a 316(b) study (to determine entrainment impacts) and / or implementing BAT jointly with the owners of the power plant, dependent on the timing of the study and improvements relative to the development of the desalination plant (EDAW, 2004). Re-design intake with state-of-the-art screens (EDAW, 2004) or consider alternative intake location (CCC, 2003).
	General Desalination - Transmission pipelines, pump stations, and other appurtenant facilities Construction of transmission pipelines, pump stations, and other facilities would result in minimal effects to the aquatic environment associated with stormwater runoff to nearby creeks and drainages.	Implement erosion and sediment control best management practices (BMPs) to prevent discharges into adjacent water bodies.
Terrestrial Resources	**General Desalination** No effects to sensitive habitats if facilities are located within existing disturbed properties (e.g., power plants, Water Quality Control Plant [WQCP], roadways, etc.). Potential impacts to sensitive resources if facilities are located in or adjacent to riparian / tidal / open space areas, or other sensitive habitats (EDAW, 2004).	Further studies on a case-by-case basis to identify the type and amount of habitats and species affected. If avoidance of sensitive biological resources is infeasible, then minimize impacts through alternative siting, special construction techniques or restriction on construction schedule. Other measures include: implement standard BMPs, consult with regulatory agencies; conduct habitat assessments, and sensitive species / preconstruction surveys; acquire relevant permits and comply with permit conditions (EDAW, 2004).
Wetland Resources	**General Desalination** No effects to wetlands resources, if facilities are located within existing, disturbed properties (e.g., power plants, Water Quality Control Plant [WQCP], roadways, etc.). Potential impacts to wetlands resources if facilities are located within these areas (EDAW, 2004).	Further studies on a case-by-case basis to identify the type and amount of wetlands and associated species affected. If avoidance of these resources is infeasible, then minimize impacts through alternative siting, special construction techniques, or restriction on construction schedule. Other measures

Table E4.A-1
Potential Environmental Impacts and Mitigation Opportunities
Desalination Concepts

Issue Area	*Potential Effects*	*Mitigation Opportunities*
	RDP – Near Bay Bridge Site Depending on the location of concept facilities, potential for adverse effects to salt marshes, salt marsh harvest mouse, clapper rail, and other sensitive wetland resources.	include: implement standard BMPs, consult with regulatory agencies; conduct habitat assessments, wetland delineations, and sensitive species/preconstruction surveys; acquire relevant permits and comply with permit conditions, replacement at 3:1 ratio (actual ratio determined by negotiations with regulatory agencies), monitoring (EDAW, 2004).
Energy	**General Desalination** RDP – Mirant Pittsburg or Antioch Desalination Concept: 40 MGD plant: 104 million kwh; 120 MGD plant: 346 million kwh RDP - Near Bay Bridge Desalination Concept: 263 million kwh (CDM, 2004). RDP - Oceanside: 305 million kwh (CDM, 2004). Mirant Pittsburg or Antioch Desalination Concept with Zone 7 and Near Bay Bridge Desalination with Zone 7 - Actual energy consumption not known, but would be associated with additional operation of the plant, as well as pipeline and pump station operations.. South Bay Desalination Concepts: 3,250 kwh/mg (CDM, 2004).	Energy recovery devices, installed as part of concept development, would reduce overall energy consumption. Enroll in a voluntary PG&E Demand Response Program to reduce demand on the electrical system during peak consumption periods
	Desalination – Co-location with Power Plant Where co-location would occur at power plants, the power plant could supply energy to the desalination facility, thereby reducing the need to increase transmission capacity elsewhere on the energy grid. However, this may have an effect on local or regional electric demand (CCC, 2003). If the power plant shuts down, no electricity would be available to run the desalination facility.	Provision of an alternative energy source if electricity from the existing power plant is not available.
Groundwater	**South Bay Desalination and Concept** Potentially deplete groundwater resources through increased pumping; potential for salt water intrusion (EDAW, 2004).	Conduct hydrogeologic investigations to determine safe yield of basin. As needed, develop more wells that pump at lower rates to reduce concentrated pumping, and scatter well sites to areas where groundwater is not depleted locally. Implement a program to monitor groundwater levels (EDAW, 2004).
	Operation of extraction wells may interfere with production of existing groundwater production wells (EDAW, 2004).	Require minimum spacing between proposed and other existing public and private production wells (EDAW, 2004).
Land Use / Planning	**General Desalination** Implementation of the desalination plant may conflict with adopted plans, policies, and regulations of the affected jurisdictions. In addition, potential conflicts with the designated uses (zoning) of the development site.	Comply with adopted plans, policies and regulations; locate facilities in areas consistent with land use designations and zoning.
	RDP – Near Bay Bridge Site If the desalination plant is located at the former Oakland Army Base, potential conflict with the planned uses of the Gateway Development Area Final Reuse Plan could occur.	Coordinate with the Oakland Base Reuse Authority to determine how the desalination facility could be integrated into the site.

Table E4.A-1
Potential Environmental Impacts and Mitigation Opportunities
Desalination Concepts

Issue Area	*Potential Effects*	*Mitigation Opportunities*
	RDP – Oceanside Site Locating the Oceanside Site adjacent to the ocean could conflict with policies of the Local Coastal Program or National Park Service (NPS) (EDAW, 2004).	Locate the larger facilities inland, away from the shoreline, so as not to preclude coastal-dependent development. Acquire permit from the Coastal Commission; coordinate with NPS on facility siting if facilities are located within NPS property. .
Noise	**General Desalination** Ambient noise may increase from operations of desalination facility and ancillary facilities (i.e., pumps). If facilities are located at a power plant or other industrial use, adverse noise effects would unlikely occur. However, potential adverse noise effects may occur if facilities are located adjacent to sensitive receptors (residential uses) (EDAW, 2004).	Install mufflers on equipment; install residential-rated noise attenuation where applicable; compliance with noise standards of affected jurisdictions (EDAW, 2004).
Aesthetics	**General Desalination** Desalination facilities would not degrade the visual quality of the site and surrounding area if they are located at an existing power plant or industrial site. Facilities could alter the surrounding character of an area if located within other land uses or if it blocks protected, scenic views. Installation of associated ancillary facilities (i.e., pump stations) may change minimally the surrounding character, depending on the site location (EDAW, 2004).	Locate facility in areas that would not affect scenic highways or vistas; design facility to integrate with surrounding uses; application of architectural treatment, as needed (EDAW, 2004).
Recreation	**General Desalination** Construction of desalination facilities could result in temporary disturbance to existing recreational facilities (i.e., parks, trails, etc.) and / or temporarily affect existing recreationists (i.e., park users, hikers, beachgoers, surfers, kayakers, etc), depending on the location of the facilities.	Avoid siting the plant and ancillary facilities in areas that would affect existing recreational users, if feasible. Otherwise, site facilities to reduce recreation effects. Install signage and fencing around construction zones as appropriate. In addition, expedite construction activities in recreation areas that have been closed to accommodate construction (EDAW, 2004)
	RDP – Near Bay Bridge Site The proposed desalination facilities may permanently limit recreation opportunities (development or access) at the former Oakland Army Base, depending on its final location.	Locate facilities away from the shoreline or areas designated for future recreation.
	RDP – Oceanside Site Construction of intake facilities could affect Golden Gate National Recreation Area.	Temporary closure of the disturbed areas from public access (EDAW, 2004).
Hazardous Materials	**General Desalination** Delivery, storage, and use of chemicals associated with desalination plant operations could increase risk of accidents (EDAW, 2004).	Prepare HMMP per local, county, and state requirements; compliance with regulations concerning the use, storage, and handling of hazardous materials (EDAW, 2004).
	Construction of facilities, particularly within industrial (i.e., existing power plant, Oakland Army Base, etc.) and commercial areas could potentially encounter contaminated soils or water (EDAW, 2004).	Follow proper excavation and disposal methods per local, county, and state regulations (EDAW, 2004).

Table E4.A-1
Potential Environmental Impacts and Mitigation Opportunities
Desalination Concepts

Issue Area	***Potential Effects***	***Mitigation Opportunities***
Air Quality	**General Desalination** Implementation of a desalination plant would result in indirect air emissions associated with production of energy (for desalination plant operations); impacts may occur elsewhere where air quality violations already exist (CCC, 2003).	Comply with local air district and State Air Resources Board; reduce energy use (e.g., energy recovery device) (CCC, 2003). Operate plant during off-peak hours (DTC, 2003).
Soils and Geology / Hydrology	**General Desalination** Siting of the facility in an area susceptible to seismic, soils, geologic, or flooding hazards (EDAW, 2004).	Design and construct desalination facility per UBC code; site facility outside of the 100-year floodplain, if feasible (EDAW, 2004).
Cultural Resources	**General Desalination** Potential encountering of known/recorded or unknown/unrecorded cultural resources from construction of desalination facilities (EDAW, 2004).	Implement standard procedures in the event of encountering cultural resources (EDAW, 2004).
Socioeconomic impacts	**General Desalination** Water would be provided to all customers regardless of income levels (EDAW, 2004).	None required
Growth Inducement	**General Desalination** Potential for growth inducement if plant provided water beyond that approved in the affected jurisdictions' General Plans. Potential for secondary effects of growth if water would reduce barriers to development.	Limit the increment of water produced from the desalination process to the approved demands of the affected jurisdictions. Mitigation measures of affected jurisdictions' General Plans or development projects may reduce secondary growth-related effects.
Construction activities	**General Desalination** General disruption of surrounding land uses, from construction noise, dust, traffic, etc.; such effects would be reduced if located within an existing power plant or other industrial areas. Generally, construction activities would be temporary in nature and limited in extent. (EDAW, 2004).	Implementation of standard best management practices (i.e., noise muffling), traffic control plan, limitations on the construction schedule and timing, erosion and sediment control, etc. where relevant (EDAW, 2004). Increase public coordination / involvement to address land use conflicts.
Distinction between the 40 mgd and 120 mgd Desalination Facility	**RDP- Mirant Pittsburg Desalination** The larger capacity plant would require a larger site footprint; however, it is not anticipated to result in greater siting impacts because the facility would be accommodated within the existing power plant property. Operational impacts would differ. Energy, for example, would increase with the larger capacity plant. The amount of intake and discharge would incrementally increase with the larger plant. As described above, larger pipelines may be needed for the larger capacity plant; however, as the length would not increase, such impacts are not anticipated to result in substantial incremental effects (EDAW, 2004).	See mitigation opportunities above for the different issue areas.

Note:

(1) The Delta is considered a migration corridor for steelhead. The Sacramento splittail was identified in the RDP Pre-Feasibility Report; however, this species has been delisted.

Table E4.A-2
Summary of Permitting and Consultation Requirements
Regional Desalination Project

Agency	*Type of Permit*
United States Army Corps of Engineers	Section 404/10, General or Individual
California Department of Fish and Game	Streambed Alteration Agreement
California Coastal Commission	Coastal Development Permit
California Energy Commission (CEC)	Modification of CEC permit
Regional Water Quality Control Board	Section 401 Water Quality Certification Section 402, NPDES General Construction Activity Storm Water Permit
State Water Resources Control Board	Water Right Permit
United States Fish and Wildlife Service	Section 7 Consultation
NOAA Fisheries	Consultation to USFWS
State Lands Commission	Dredging Permit
State Historic Preservation Office	Section 106 Compliance, National Historic Preservation Act
California Department of Health Services	Amendment to Domestic Water Supply Permit
Bay Area Air Quality Management District	Authority to Construct and Permit to Operate (for stationary sources that emit pollutants)
City and County of San Francisco, Contra Costa County, and/or Alameda County	Hazardous Materials Permit
Cities of Pittsburg or Antioch, Pleasanton, Livermore, and other jurisdictions where pipeline(s) would cross	Encroachment Permits
Caltrans	Encroachment Permit
Railroad	Encroachment Permit

Table E4.A-3
Summary of Permitting and Consultation Requirements
Mirant Pittsburg or Antioch Desalination with Water Quality Element

Agency	***Type of Permit***
United States Army Corps of Engineers	Section 404/10, General or Individual
California Department of Fish and Game	Streambed Alteration Agreement
Regional Water Quality Control Board	General Construction Activity Storm Water Permit
United States Fish and Wildlife Service	Section 7 Consultation
NOAA Fisheries	Consultation to USFWS
State Lands Commission	Dredging Permit
State Historic Preservation Office	Section 106 Compliance, National Historic Preservation Act
California Department of Health Services	Amendment to Domestic Water Supply Permit
Bay Area Air Quality Management District	Authority to Construct and Permit to Operate (for stationary sources the emit pollutants)
City of Pittsburg or Antioch	Encroachment Permit
Caltrans	Encroachment Permit
Railroad	Encroachment Permit

Table E4.A-4
Summary of Permitting and Consultation Requirements
Near Bay Bridge Desalination with Water Quality Element

Agency	*Type of Permit*
United States Army Corps of Engineers	Section 404/10, General or Individual
California Department of Fish and Game	Streambed Alteration Agreement
Regional Water Quality Control Board	General Construction Activity Storm Water Permit
United States Fish and Wildlife Service	Section 7 Consultation
NOAA Fisheries	Consultation to USFWS
State Lands Commission	Dredging Permit
State Historic Preservation Office	Section 106 Compliance, National Historic Preservation Act
California Department of Health Services	Amendment to Domestic Water Supply Permit
Bay Area Air Quality Management District	Authority to Construct and Permit to Operate (for stationary sources the emit pollutants)
City of Oakland	Encroachment Permit
Caltrans	Encroachment Permit
Railroad	Encroachment Permit

Table E4.A-5
Summary of Permitting and Consultation Requirements
South Bay Desalination Concept

Agency	***Type of Permit***
United States Army Corps of Engineers	Section 404/10, General or Individual
California Department of Fish and Game	Streambed Alteration Agreement
Regional Water Quality Control Board	General Construction Activity Storm Water Permit
State Historic Preservation Office	Section 106 Compliance, National Historic Preservation Act
California Department of Health Services	Amendment to Domestic Water Supply Permit
Bay Area Air Quality Management District	Authority to Construct and Permit to Operate (for stationary sources the emit pollutants)
Cities of Palo Alto, Santa Clara, or San Jose	Encroachment Permit
Santa Clara County	Well development permits

Table E4.A-6
Summary of Permitting and Consultation Requirements
East Bay Saline Groundwater Desalination Concept

Agency	***Type of Permit***
United States Army Corps of Engineers	Section 404/10, General or Individual
California Department of Fish and Game	Streambed Alteration Agreement
Regional Water Quality Control Board	General Construction Activity Storm Water Permit
State Historic Preservation Office	Section 106 Compliance, National Historic Preservation Act
California Department of Health Services	Amendment to Domestic Water Supply Permit
Bay Area Air Quality Management District	Authority to Construct and Permit to Operate (for stationary sources the emit pollutants)
Cities of Fremont	Encroachment Permit
Alameda County	Well development permits

E5. Bay Area Use of the Freeport Regional Water Project

Appendix E5
Bay Area Use of the Freeport Regional Water Project

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Appendix E5
Bay Area Use of the Freeport Regional Water Project

1.0 Concept Overview

1.1 Description

Bay Area Use of the Regional Use of Freeport Regional Water Project Concept Summary

Extended Dry Year Supply …………0 AFY

Average Year Water Quality Supply, up to 15,000 AFY

Cost ($2005)
Capital Cost .... TBD in future studies
O&M Cost .... TBD in future studies
Unit Cost................................. TBD in future studies

Potential Owning Agency
EBMUD

Potential Partners
Zone 7

EBMUD and Sacramento County Water Agency (SCWA) have formed a Joint Powers Authority called the Freeport Regional Water Authority (FRWA) to implement the Freeport Regional Water Project (FRWP). The project would provide up to 100 mgd of dry-year supply for EBMUD from a new diversion located on the Sacramento River near Freeport. New pipelines would convey water from the Sacramento River to the Folsom South Canal, and from the canal to the Mokelumne Aqueduct. The project would also provide up to 85 MGD to SCWA to meet future needs. EBMUD would take delivery of water through the Freeport project facilities only in years when its projected total system storage falls below target levels, to reduce drought impacts to customers. In average[1] and wet years, conveyance facilities could potentially be used by others. The Final Environmental Impact Report for the Freeport Project was released in March 2004 and certified in April 2004. The Environmental Impact Statement was certified in January of 2005.

The Bay Area Regional Water Quality and Supply Reliability Study is evaluating potential use of Freeport facilities during average and wet years to convey water to other interested Bay Area water agencies. The Freeport Project EIR includes negotiated settlement agreements with other water agencies. As part of the settlements, Contra Costa Water District (CCWD) has limited access to Freeport Project facilities for the purposes of wheeling a limited amount of their CVP water. With the exception of the settlement agreements, the Freeport Project EIR did not evaluate the potential for other uses of the Freeport project facilities in non-drought years. Additional environmental documentation will be required to utilize this potential.

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[1] The term "average" is used throughout this document to indicate normal year hydrology.

1.2 Potential Partners and Supply Amounts

Table E5-1 summarizes potential partners for Bay Area Use of Freeport Regional Project. Several agencies including those from outside the Bay Area have expressed interest in utilizing the unused capacity in the Freeport Project facilities. Regional entities in San Joaquin County and the Mokelumne region have individually and collectively via the Mokelumne Water Forum approached EBMUD about utilizing unused capacity in the Freeport Project facilities for groundwater banking and recharge projects. The two Bay Area agencies that would potentially be the easiest to connect to EBMUD for transfer of water through the Freeport facilities are the CCWD, and the Zone 7 Water Agency. There is also the potential for transfer through the EBMUD system and the emergency interconnection to the City of Hayward. However, that connection is currently only permitted for emergency use.

CCWD has indicated they are not interested in participating in a Freeport Regional Project beyond the negotiated settlement included in the Freeport EIR due to cost. Zone 7 Water Agency is not a participant in the Freeport Regional Project, but could potentially be interested in water for water quality blending and/or for groundwater storage and subsequent extraction for drought or peaking supply.

Water could be delivered through existing interconnections to Zone 7 customer Dublin-San Ramon Services District (DSRSD), or through a new interconnection to the Zone 7 system from the EBMUD system in San Ramon[2]. Conceptual-level facilities and cost estimates for the concept are based on earlier evaluations of the EBMUD and Zone 7 systems (CDM, 2004) and assume connection to the Zone 7 system.

Table E5-1
Potential Partner and Supply Amounts

Agency	Type of Benefit	Potential Amount (Acre-Feet/Year)	Notes/Issues
EBMUD	Owning Agency		
Zone 7 Water	Dry-Year Supply	0 AFY	Deliveries via new 25 MGD connection between EBMUD and Zone 7, for direct delivery for blending, or for storage in groundwater basin for subsequent extraction.
	Average Year Water Quality	Up to 15,000 AFY	

Dry-Year Supply

This concept has no regional dry-year supply element because the capacity of EBMUD's Freeport Project facilities would be used by EBMUD to meet their dry-year supply needs.

---

[2] EBMUD is currently evaluating a variety of different options for bringing Freeport deliveries into the EBMUD system, including not blending or pre-treating and making deliveries in a dedicated aqueduct, which would significantly affect concept operation and water quality. This concept assumes blending of Freeport supplies with Mokelumne Aqueduct supplies, and does not address the other potential alternatives being evaluated by EBMUD.

Average Year Water Quality

Zone 7 is a potential participant in the project because it could improve their water quality in average years, and if stored in their aquifer, possibly in dry years as well. Deliveries to Zone 7 would be through EBMUD's San Ramon Valley distribution system, with a new interconnection sized to deliver up to 25 MGD to the Zone 7 system. Deliveries would be limited to lower demand periods (November through May) when excess capacity is available in the Mokelumne Aqueduct and in the EBMUD distribution system.

The current study has estimated potential average year deliveries to Zone 7 for water quality improvement based on the following assumptions:

- Zone 7 -- Up to 25 MGD, with deliveries from November through May (15,000 AFY, using a 95% operating factor during delivery months).

Other Partners Considered But Not Included

The following other potential partners were considered but not included.

Agency	*Type of Benefit*	*Reason Not Included*
CCWD	Average year water quality	Not seeking average year water for blending.
BAWSCA/City of Hayward	Average year water quality	Not seeking water for blending in average year

Note: CCWD receives Freeport water as part of the settlement agreement. They are not interested in receiving additional water.

1.3 Operating Description

The Bay Area Use of Freeport Regional Project would divert water from the Sacramento River and convey it through the Freeport facilities, Mokelumne Aqueduct and EBMUD distribution system, for delivery to Zone 7. This concept assumes that water delivered to Zone 7 would be either State Water Project (SWP) water or Sacramento River water purchased by Zone 7. Use of either SWP water or other supplies may require modification of existing water rights or acquisition of new water rights by Zone 7.

Water could be conveyed to the Zone 7 distribution system via a new intertie connecting the southern part of EBMUD's San Ramon Valley system with Zone 7 transmission facilities. This study assumed an intertie size of up to 25 MGD. A new regulating station and up to 40,000 feet of new pipeline would be required for this capacity.

Water for blending to improve water quality would be delivered to Zone 7 during the rainy season of average and wet years (November through May), when excess capacity is available in the EBMUD distribution system. Zone 7 could use the water directly to blend with other supplies, or could potentially inject the water into its groundwater basin for subsequent extraction. Further study would be required to determine the feasibility of groundwater injection and the benefits to the groundwater basin in controlling or reducing salinity.

2.0 Project Facilities

Figure E5-1 and Table E5-2 summarize the proposed facilities for this concept.

Table E5-2
Project Facilities for Bay Area Use of the Freeport Regional Water Project

Facility	*Notes*
Pipeline from EBMUD to Zone 7 (25 MGD): • Regulating Station and, 39" diameter pipeline, up to 40,000 feet.	Conceptual alignment from San Ramon Pressure Zone to north end of Zone 7's Treated Water Transmission System in Dublin.

1. Assumes blending with Mokelumne supplies. EBMUD is studying more than one option and could ultimately use dedicated aqueduct deliveries to terminal storage without Mokelumne blending.

2.1 Basis for Facility Sizing

Information for a potential intertie between EBMUD and Zone 7 systems is based on general information from EBMUD and Zone 7 systems.

Deliveries to Zone 7 would be conveyed through the EBMUD system, and would be constrained by the available capacity of the Mokelumne Aqueduct and EBMUD's distribution system. Information from previous studies indicates that in general, excess capacity is available in winter months, but not in summer months.

3.0 Engineering Analysis

This section provides an engineering analysis for engineering aspects of the project that will be assessed further in the detailed concept and portfolio evaluation (the "scorecard"). Where information is currently available it has been included in the following sections. However, much of the scorecard data will be developed after agreement on the concepts.

3.1 Project Costs

Table E5-3 summarizes project capital, operating and annualized costs.

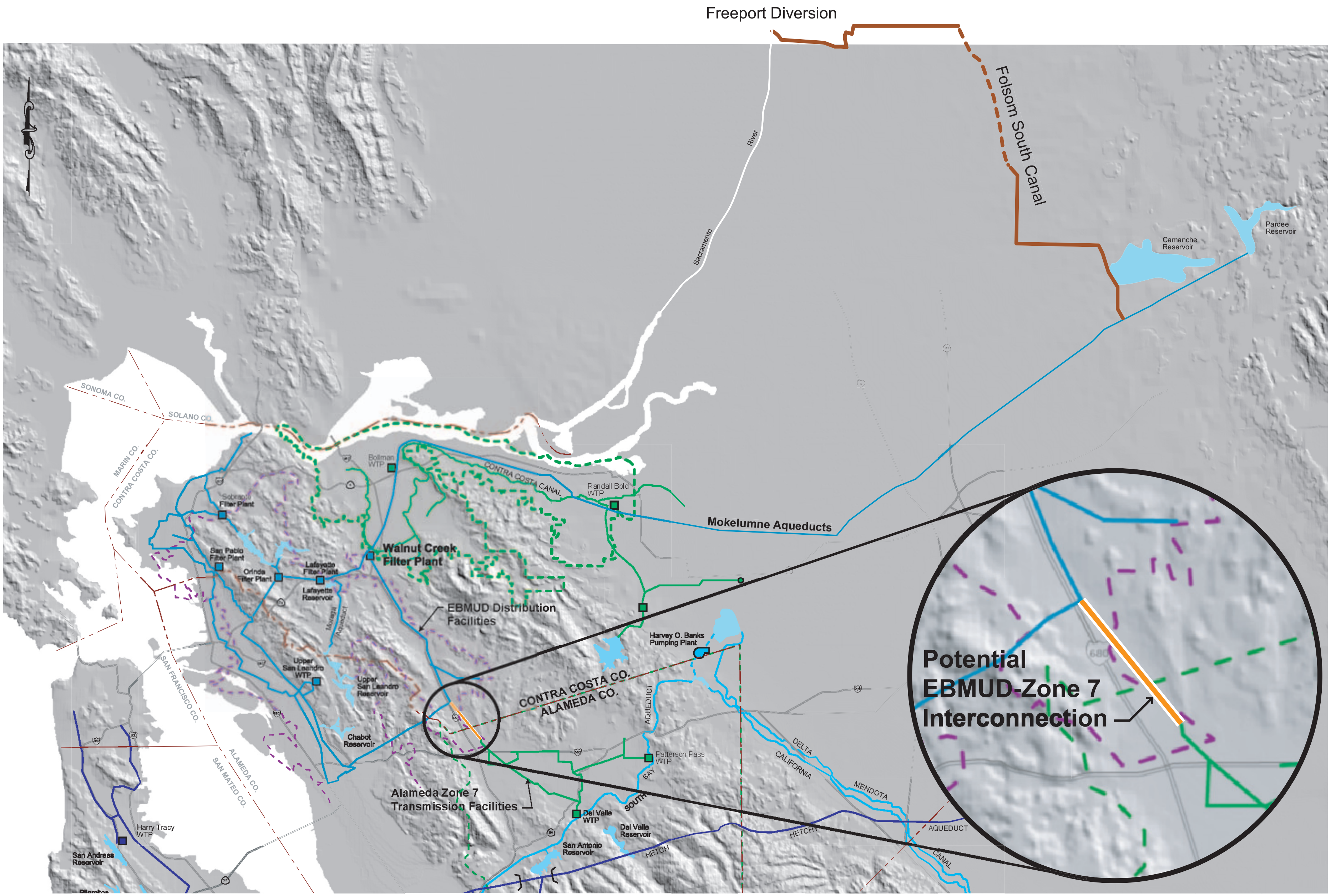

Figure E5-1

Bay Area Regional Use of Freeport Regional Water Project

CDM

W:\REPORTS\ABAG\Bay Area WQ&WSRP\Final Report Mar 2005\Graphics\Appendix E\Freeport\Bay Area Region Use Freeport (Fig E5-1).ai 03/02/05

Table E5-3
Estimated Project Costs[1]

Capital Costs	
Pipeline[2]	$24 M
Pressure Reducing Station	$ TBD
Total Capital Cost	$ TBD
Operating Costs	
Power – Pumping to Freeport, and within EBMUD system	$ TBD
EBMUD treatment	$ TBD
Conveyance/wheeling cost	$ TBD
Total Operating Cost	$ TBD
Annual Costs	
Annualized Capital Costs	$ TBD
Operating Costs	$ TBD
Total Annual Cost	$ TBD

[1] Costs will include the FRWP capital recovery and O&M, and Mokelumne Aqueduct capital and O&M, including aqueduct pumping.

[2] Conceptual-level intertie cost.

Basis for Cost Estimates

- Capital Costs: TBD. Capital costs for the Zone 7 – EBMUD interconnection only are estimates at $24 M ($2005).

- Environmental Mitigation: Costs would be dependent on site-specific impacts and conditions set forth by the regulatory agencies, if any. In general, mitigation costs could range from one to five percent of the total capital costs.

- Operating Costs: TBD

- Annual Costs: TBD

3.2 System Vulnerability

System vulnerability is defined as susceptibility of facilities to damage or failure from catastrophic events, such as earthquakes. Conveyance of a portion of Zone 7's supply through the Freeport and EBMUD system would provide a limited reduction in system vulnerability. The major transmission facilities would have a similar probability of failure during a seismic event to that of the Zone 7 interconnection facilities. However, the project would provide an entirely separate connection point to Zone 7 if the South Bay Aqueduct flows were to be interrupted.

3.3 Supply Reliability

This concept would provide no dry year supply reliability for Zone 7.

3.4 Water Quality

Conveyance of Freeport water to Zone 7 would provide improved water quality over the Delta supply. However, this would result in a marginal degradation to the EBMUD supply. The average long term TDS for Freeport, based on Greene's Landing water quality monitoring data is approximately 101 mg/L, which is poorer water quality than typical EBMUD supplies. EBMUD has suggested they would accept water containing these TDS concentrations. For the purposes of this analysis, this water is assumed to be blended with Mokelumne Aqueduct water, treated by EBMUD and conveyed to Zone 7.

3.5 Schedule

A schedule will be defined as the project is developed in future studies.

4.0 Environmental Analysis

This section summarizes the environmental analysis for this concept under the general environmental categories that will be presented in the detailed concept and portfolio evaluation (the "scorecard"). A more comprehensive environmental summary is included as Appendix A. Information in this section is developed in part from review of the Draft Environmental Impact Report/Environmental Impact Statement for the Freeport Regional Water Project (Jones and Stokes, 2003). Any potential environmental impacts and proposed mitigations presented here are those of CALFED and their consultants.

4.1 Potential Environmental Benefits

Environmental benefits are defined as an overall improvement to some aspect of environmental quality, to the land, air, or water. Storage of water from the Sacramento River in the Zone 7 aquifer could reduce groundwater salinity. Because Zone 7 utilizes some groundwater for drinking purposes, reduction of salinity would improve wastewater quality and increase water recycling opportunities.

4.2 Potential Environmental Impacts

Environmental impacts are defined as potential degradation in the quality of the environment that will likely require mitigation. Table E5-4 summarizes potential environmental impacts for the project, identifying the issue area, potential impacts and mitigation opportunities for aquatic resources, terrestrial resources, wetlands and energy consumption. Other potential environmental impacts, including but not limited to land use and construction-related effects, are discussed in Appendix A.

Table E5-4
Summary of Potential Environmental Impacts
Bay Area Use of the Freeport Regional Water Project

Issue Area	***Potential Effects***	***Mitigation Opportunities***
Delta Resources (Aquatic)	Diversion of water during wet and average years of winter months (under high flow conditions) would be unlikely to have adverse effects on Delta fisheries because less than one percent of flow would be diverted in any winter month, and the existing intake is equipped with a fish exclusion system. Additional studies would be required to confirm this assessment. If impacts occur, the fisheries resources that could be affected include Delta smelt, Sacramento splittail, Chinook salmon, and steelhead.	Conduct additional studies to determine the incremental effects of operations on sensitive fisheries and establish appropriate measures to reduce impacts, if any.
Biological Resources (Terrestrial)	Facilities would likely be located within previously disturbed, urban areas and thus would not affect sensitive resources. Potential impacts would occur if facilities are located within sensitive areas.	If avoidance is infeasible, implement methods that would minimize impacts (e.g., restrictions on construction schedule) (EDAW, 2004).
Wetlands	Facilities would likely be located within previously disturbed, urban areas and thus would not affect wetlands. However, in the event that wetlands cannot be avoided, potential effects would occur.	If avoidance is infeasible, implement methods that would minimize (e.g., restrictions on construction schedule, BMPs) or compensate for impacts (EDAW, 2004).
Energy	Operation of the existing facilities during the average to wet years would require consumption of nonrenewable energy. However, this energy use would be offset by reduction in pumping of SBA facilities.	NA

5.0 Regulatory and Institutional Analysis

This section summarizes the regulatory and institutional evaluation for this concept for the general categories that will be assessed in the detailed concept and portfolio evaluation (the "scorecard").

5.1 Permitting

Typical permits for infrastructure projects (e.g., pipeline construction and operation) include those from the Corps, RWQCB, and CDFG and local and regional agencies where these facilities are located. Depending on the special-status species affected (particularly from the increased operation of the Freeport intake), consultation with USFWS and NOAA may also be required. Permits and consultation from these agencies would only be required if there is potential for adverse effects to sensitive biological resources. Zone 7 would also need to acquire a change in point of diversion.

The consultation process with USFWS (if necessary) and acquisition of a water rights amendment may affect both the implementation schedule and mitigation costs. To shorten the duration, the permitting process could occur in parallel with CEQA/NEPA environmental process; however, that requires that adequate engineering and design details are developed for submission to the regulatory agencies. The precise duration for the permitting process cannot be determined at this time, but would likely take at least two years for the CEQA/NEPA process and consultation with USFWS and NOAA.

For a list of anticipated permitting and consultation requirements, refer to Appendix E5.A.

5.2 Institutional Issues

The potential participating agencies (EBMUD, Zone 7) would be required to prepare and adopt individually joint agreements (i.e., Memorandum of Understanding, Memorandum of Agreement, and Operations Agreement) outlining individual agencies' commitment to fund (capital costs, operations and maintenance costs), and operate the project. The operations agreement would include, but not be limited to, discussions of individual agencies' responsibilities for operation of the joint facility, the quantity of water allocated to each party, and the timing such deliveries would occur.

Changes in the diversion location of Zone 7 SWP water may require changes to the existing contract agreements. This may also be true for changes in the points of diversion of other supplies.

The Sacramento Municipal Utility District (SMUD) is currently the primary recipient of water being conveyed in the Folsom South Canal. A specific analysis of potential economic impacts to SMUD which would result from changed water quality in the FSC would also be required.

6.0 Outstanding Issues and Questions

There are no outstanding issues associated with this concept.

References

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Freeport Regional Authority, 2004. *About the Freeport Regional Water Project.* Available at: http://www.freeportproject.org/about.html. Accessed: April 23, 2004.

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Appendix E5.A

Summary of Environmental Analysis – Freeport Regional Water Project

Table E5.A-1
Potential Environmental Impacts and Mitigation Opportunities
Bay Area Use of the Freeport Regional Water Project

Issue Area	***Potential Effects***	***Mitigation Opportunities***
Delta Resources (Aquatic)	Diversion of water during wet and average years of winter months (under high flow conditions) would be unlikely to have adverse effects on Delta fisheries because less than one percent of flow would be diverted in any winter month, and the existing intake is equipped with a fish exclusion system. Additional studies would be required to confirm this assessment. If impacts occur, the fisheries resources that could be affected include Delta smelt, Sacramento splittail, Chinook salmon, and steelhead.	Conduct additional studies to determine the incremental effects of operations on sensitive fisheries and establish appropriate measures to reduce impacts, if any. If adverse effects occur, then acquire relevant permits and comply with permit conditions to protect sensitive resources.
Biological Resources (Terrestrial)	Pipelines, connections, and a regulating station would likely be located within previously disturbed, urban areas and thus would not affect sensitive resources. Potential impacts would occur if facilities are located within sensitive areas.	If facilities are located within sensitive areas, further field investigations would be required to identify the type and amount of habitats and species affected. If avoidance through relocation or special construction techniques is infeasible, then minimize impacts through restrictions on construction schedule, BMPs, acquisition of relevant permits, compliance with permit conditions, monitoring, etc. (EDAW, 2004).
Wetlands	Pipelines, connections, and a regulating station would likely be located within previously disturbed, urban areas and thus would not affect wetlands. Potential impacts would occur if wetlands cannot be avoided.	If facilities are located within wetlands, wetland delineations would be required to identify the type and amount affected. If avoidance through relocation or special construction techniques is infeasible, then minimize impacts through restrictions on construction schedule, acquisition of relevant permits, compliance with permit conditions (e.g., wetland creation at a 3:1 ratio [actual ratio determined by negotiations with regulatory agencies], monitoring, etc.) (EDAW, 2004).
Energy	Operation of the existing facilities during the normal to wet years would require consumption of nonrenewable energy. However, this energy use would be offset by reduction in pumping of SBA facilities	NA
Land Use / Planning	Implementation of the proposed concept may conflict with adopted plans, policies, and regulations (EDAW, 2004).	Compliance with adopted plans, policies and regulations; acquire relevant permits and comply with permit conditions.

Table E5.A-1
Potential Environmental Impacts and Mitigation Opportunities
Bay Area Use of the Freeport Regional Water Project

Issue Area	***Potential Effects***	***Mitigation Opportunities***
Noise	Noise increases associated with operation of the existing facilities during normal and wet years would be unlikely to result in adverse impacts, as these facilities would likely be enclosed or equipped with noise attenuation devices where they are located in the vicinity of sensitive receptors (EDAW, 2004).	NA
Hazardous Materials	Contaminated soils or water may be encountered during construction (EDAW, 2004).	Proper excavation and disposal methods per local, county, and state regulations (EDAW, 2004).
Soils and Geology / Hydrology	Siting of facilities in an area susceptible to seismic, soils, geologic, or flooding hazards (EDAW, 2004).	Design and construct facilities per UBC code; site facility outside of the 100-year floodplain, if feasible (EDAW, 2004).
Cultural Resources	Recorded or unrecorded cultural resources may be encountered during construction of the regulating station and pipeline (EDAW, 2004).	Implement standard procedures in the event of encountering cultural resources (EDAW, 2004).
Socioeconomics	Water would be provided to all customers regardless of income level (EDAW, 2004).	NA
Growth Inducement	Potential for growth inducement and secondary effects of growth (as provision of water could reduce barriers to development).	Mitigation measures of affected jurisdictions' General Plans or development projects would reduce potential growth-related effects (as long as provision of water does not exceed amount approved by affected jurisdictions).
Construction activities	Limited facilities would be built as this concept would make use of existing facilities that would be constructed as part of the Freeport Regional Water Project. Construction of the regulating station and pipeline may disrupt adjacent land uses if occurring in areas of residential and commercial uses, but would be temporary in nature and limited in extent (EDAW, 2004).	Implementation of standard best management practices (i.e., erosion and sediment control, noise muffling), traffic control plan, limitation on the construction schedule, etc. where relevant (EDAW, 2004).

Table E5.A-2
Summary of Permitting and Consultation Requirements

Agency	***Type of Permit***
United States Army Corps of Engineers	Section 404, General or Individual
California Department of Fish and Game	Streambed Alteration Agreement
Regional Water Quality Control Board	General Construction Activity Storm Water Permit
United States Fish and Wildlife Service	Section 7 Consultation
NOAA Fisheries	Consultation to USFWS
State Water Resources Control Board	Appropriative Water Right Permit Amendment or Change Petition
Bay Area Air Quality Management District	Authority to Construct and Permit to Operate (stationary sources that emit pollutants)
Various	Relevant encroachment permit(s) Water quality impacts to SMUD

E6. Enhanced Water Conservation Concept

Appendix E6
Enhanced Water Conservation Concept

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Acronyms

ACWD	Alameda County Water District
AF	Acre-feet
AFY	Acre-feet per year
BAWUA	Bay Area Water Users Association
BMP	Best Management Practices
California PUC	California Public Utilities Commission
CCWD	Contra Costa Water District
CII	Commercial, Institutional, and Industrial
CIMIS	California Integrated Management Information System
EBMUD	East Bay Municipal Utility District
ET	Evapotranspiration
IRIS	Irrigation Reduction Information System
ITAP	Irrigation Technical Assistance Program
MF	Multi-family
SCVWD	Santa Clara Valley Water District
SF	Single family
SFPUC	San Francisco Public Utilities Commission
ULFT	Ultra Low Flush Toilets
USD	Union Sanitary District
WUE	Water Use Efficiency
Zone 7	Alameda County Flood Control and Water Conservation District - Zone 7

Appendix E6
Enhanced Water Conservation Concept

1.0 Overview

The enhanced conservation concept involves the implementation of individual agency planned water saving programs as well as additional regional activities that will achieve greater and more effective savings. Agencies participating in this study include: Alameda County Water District (ACWD), Bay Area Water Supply and Conservation Agency (BAWSCA); Contra Costa Water District (CCWD); East Bay Municipal Utility District (EBMUD); San Francisco Public Utilities Commission (SFPUC); Santa Clara Valley Water District (SCVWD); and Zone 7 Water Agency (Zone 7). Throughout this concept these agencies are collectively referred to as "participating agencies". Similarly, the "study area" refers to the entire region where participating agencies provide water services.

1.1 Ongoing Conservation

Water conservation has and continues to be an important and integral component of Bay Area water management strategies. Water conservation is defined as "future water savings resulting from proven and reasonable management and water saving device measures. "[1] The participating agencies are committed to managing demand by aggressively advancing water conservation to improve water use efficiency. For example, agencies are working to improve conservation awareness through product labeling and certification, presenting at community events, provided web-based conservation services and conducting research on how to further penetrate the conservation market.

Bay Area agency efforts to date have resulted in several award winning and highly regarded conservation programs. "Our Water", a program sponsored by BAWSCA agencies that combines visual, literary and performing arts instruction, is an example of such a distinguished Bay Area conservation program. It was recently recognized with the "Clair A Hill Award for Excellence", granted by the Association of California Water Agencies. Innovation in conservation programs have led the Bay Area to project that over 180,000 acre-feet of water will be saved through conservation by 2020.

One important component of all agency conservation programs is the promotion and implementation of Best Management Practices (BMPs). The BMPs outlined in the California Urban Water Conservation Council's Memorandum of Understanding (MOU) for Urban Water Conservation, described in Section 1.2, are integral components of Bay Area conservation programs. The CUWCC defines BMPs as measures taken in addition to programs instituted during water supply shortages to reduce long-term urban demand[2]. Nearly all participating agencies have signed the CUWCC MOU and have pledged to implement the BMPs whenever feasible. Section 2 further discusses BMPs by describing the participating agencies' implementation and management of BMPs and award winning conservation programs.

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[1] CUWCC. Article 2 of BMP MOU adopted December 1991, last amended March 2004.

[2] CUWCC. Recital of BMP MOU, adopted December 1991, last amended March 2004.

1.2 CUWCC Best Management Practices

The California Urban Water Conservation Council (CUWCC) was created to increase efficient water use statewide through partnerships among urban water agencies, public interest organizations and private entities. CUWCC is currently comprised of over 290 members water agencies and environmental groups throughout the state. The CUWCC MOU for Urban Water Conservation outlines 14 BMPs that focus on economic, technical, management, institutional and educational approaches towards improving water conservation. All of the participating agencies have pledged to implement these BMPs whenever feasible:

BMP 1. **Water Supply Programs for Single-Family Residential and Multi-Family Residential Customers.** This BMP requires signatories to develop and implement water use surveys that involve indoor and outdoor components. Examples of survey components include: check for leaks, check showerhead flow rates, toilet flow rates, and check irrigation system. This BMP also recommends but does not require providing customers with survey evaluation results and water saving recommendations.

BMP 2. **Residential Plumbing Retrofit.** This BMP requires signatories to identify residences constructed prior to 1992 and target them for distribution or direct installation of high quality, low-flow plumbing fixtures.

BMP 3. **System Water Audits, Leak Detection and Repair.** This BMP requires signatories to complete a prescreening system audit each year in which metered sales and other verifiable uses are compared to the total supply in the system. If the uses are less than 90% of the system supply, a full-scale system audit for leak detection is required.

BMP 4. **Metering with Commodity Rates for All New Connections and Retrofit of Existing Connections.** This BMP requires signatories to meter all new connections and bill by volume of use. Signatories must also establish a program for retrofitting existing unmetered connections.

BMP 5. **Large Landscape Conservation Programs and Incentives.** This BMP requires signatories to provide customers with support and incentives to improve their landscape water use efficiency.

BMP 6. **High-Efficiency Washing Machine Rebate Programs.** This BMP requires signatories to support local, state, and federal legislation to improve efficiency standards for washing machines. Signatories may also be required to offer a cost-effective financial incentive for the purchase of a high-efficiency washing machine.

BMP 7. **Public Information Programs.** This BMP requires signatories to implement a public information program that promotes water conservation and related benefits.

BMP 8. **School Education Programs.** This BMP requires signatories to implement a school education program to promote water conservation and related benefits.

BMP 9. **Conservation Programs for Commercial, Industrial, and Institutional Accounts.** This BMP requires signatories to identify and rank commercial, industrial and institutional (CII) accounts according to their water use. These accounts are to be targeted for water use surveys, retrofits, and incentives.

BMP 10. **Wholesale Agency Assistance Programs.** This BMP requires the wholesale water suppliers to provide financial and technical support to their retail water agency customers to advance water conservation efforts and effectiveness.

BMP 11. **Conservation Pricing.** This BMP requires signatories to implement conservative pricing (i.e., rates designed to recover the cost of providing service) for its customers.

BMP 12. **Conservation Coordinator.** This BMP requires signatories to designate a water conservation coordinator to coordinate and oversee the conservation programs and BMP implementation.

BMP 13. **Water Waste Prohibition.** This BMP requires signatories to enact and enforce measures prohibiting waste of water such as gutter flooding, single pass cooling systems, non-recirculating systems in new car washes and commercial laundry systems, and non-recycling decorative water fountains.

BMP 14. **Residential ULFT Replacement Program.** This BMP requires signatories to implement a program for replacing high-water-using toilets with ultra-low-flush toilets (ULFT) in single-family and multi-family residences.

The signatories to the MOU agreed that these initial fourteen BMPs are economically justifiable on a statewide basis. Therefore, signatories are expected to exert a "good faith effort" to implement all fourteen BMPs and work towards removing institutional barriers to promote the implementation of BMPs[3]. Signatory water suppliers are required to submit standardized reports every other year to CUWCC documenting their progress on implementing BMPs.

The MOU permits the CUWCC to refine the list of BMPs as new information about feasible water saving measures becomes available. The following are potential BMPs that CUWCC is currently evaluating for inclusion in the permanent BMP list:

- Efficiency Standards for Water Using Appliances and Irrigation Devices
- Retrofit of Existing Car Washes
- Grey Water Use
- Distribution System Pressure Regulation
- Water Supplier Billing Records Broken Down by Customer Class
- Restrictions or Prohibitions on Devices that use Evaporation to Cool Exterior Spaces
- Point of Use Water Heaters, Recirculating Hot Water Systems and Hot Water Pipe Insulation
- Efficiency Standards for New Industrial and Commercial Processes[4]

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[3] CUWCC. Section 5 of BMP MOU adopted December 1991, last amended March 2004.

[4] EBMUD, in conjunction with the CUWCC and several other agencies, has submitted an application for a Water 2025 Challenge Grant from the Bureau of Reclamation to develop a model CII Plan Review Program. Rather than focusing on retro-fits and post construction conservation measures, the

2.0 Current and Planned Water Conservation

This section presents an overview of the comprehensive water conservation programs that are currently being implemented, or are planned to be implemented by the year 2020, by the participating agencies. It begins by providing an overview of conservation in the study area and then details specific conservation measures being implemented by each of the participating agencies.

2.1 Conservation in the Study Area

The comprehensive conservation programs implemented by the participating agencies have helped to improve water use efficiency in the Bay Area. The effectiveness of water conservation is demonstrated by the following historical water use trends shown in Table E6.2-1 and Figure E6.2-1:

- Although the study area population increased over 18% from 1986 to 2001, municipal and industrial (M&I) water use actually decreased by 0.6%, and residential use only increased by 5.7%.
- Effective conservation measures implemented during the 1987-1992 drought helped to reduce M&I water use by more than 18%.
- Despite increased suburban development and economic growth in the 1990s, overall water use resulted in only modest growth compared with pre-drought levels of use.

Program will target the incorporation of design measures in the pre-construction phase to more cost-effectively achieve water conservation savings.

Table E6-1
Historic Water Use Data

Category	***Year***	***Population***	***Water Use (AFY in Thousands)***	
			Total	***Residential***
Pre-drought	1986	4,686,200	1,049	561
Drought	1987	4,746,100	1,069	561
	1988	4,809,500	1,011	520
	1989	4,881,700	905	487
	1990	4,942,900	940	489
	1991	4,975,200	828	430
	1992	5,020,300	841	460
Post-Drought	1993	5,081,700	872	490
	1994	5,123,400	918	506
	1995	5,153,600	921	516
	1996	5,203,400	975	546
	1997	5,268,400	1,022	572
	1998	5,338,500	968	537
	1999	5,402,000	1,016	566
Recent	2000	5,477,900	1,041	581
	2001	5,553,100	1,043	593
Percent Change (%)		**18.5%**	**-0.6%**	**5.7%**

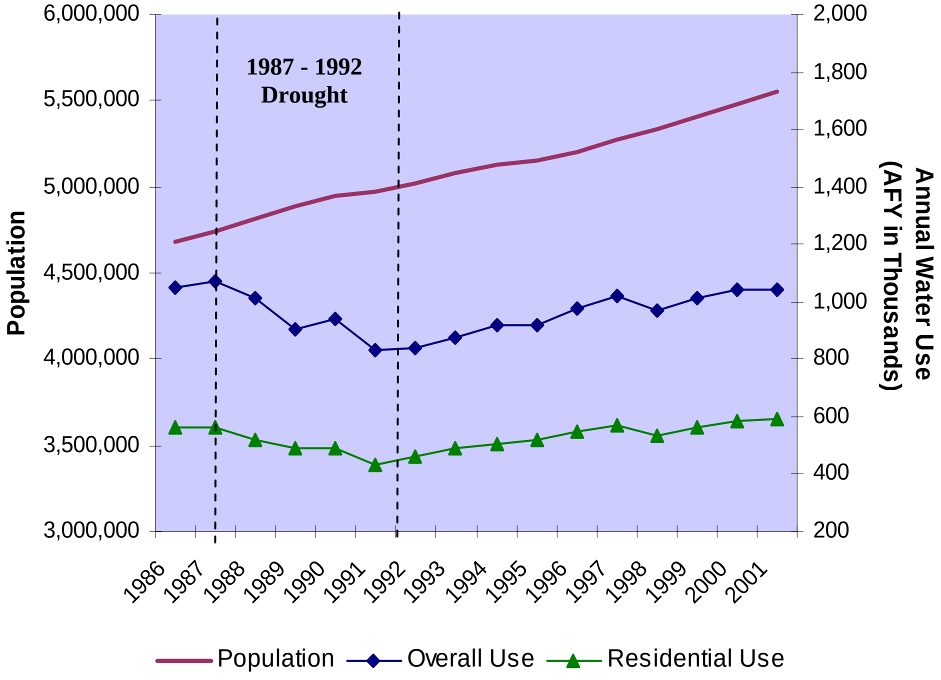

Figure E6-1
Historic Water Use Trends for the Study Area

Conservation programs in the Bay Area have led to overall regional improvements in water use and efficiency. The following paragraphs specifically describe how each agency is achieving water savings through CUWCC's BMPs as well as through other conservation efforts.

2.2 Alameda County Water District (ACWD)

A summary of ACWD's efforts towards implementing the MOU's 14 water conservation BMPs is presented in Table E6-2. Additional information for ongoing conservation programs is presented in the paragraphs that follow.

Table E6-2
Summary of ACWD BMPs (1,2)

BMP	*ACWD Progress*
1. Residential Water Surveys	• Surveyed over 8,000 residential units since 1996. • Multi-family program exceeds 10-year BMP targets
2. Residential Plumbing Retrofit	• Distributed over 30,000 kits to residential units since 1991.
3. System Water Audits	• Annual system audits indicate unaccounted flows at less than 9% (below industry average) • Over 150 miles of distribution system checked for leaks annually
4. Metering	• All accounts are metered.
5. Large Landscape Programs	• Landscape budget program implemented for dedicated landscape accounts. Over 400 sites (representing over 90% of the dedicated landscape water use) have been measured and budgeted. • Landscape survey program for mixed use accounts meets BMP targets.
6. Washing Machine Rebates	• Over 7,800 rebates provided since 1996.
7. Public Information Programs	• Program includes billing newsletters, newspaper ads, postcard reminders, press releases, website, and participation at community events.
8. School Education Programs	• Program includes classroom presentations, free resource materials, teacher training/workshops, grants, and field trips.
9. Commercial, Industrial, Institutional Programs	• Over 190 sites (291 accounts) surveyed since 1998. • Commercial ULFT and commercial clothes washer rebate programs offered in conjunction with Union Sanitary District.
10. Wholesale Assistance	• Not Applicable.
11. Conservation Pricing	• Currently using uniform rate structure • Implemented inverted block rate structure during drought.
12. Conservation Coordinator	• Conservation coordinator position is staffed.
13. Water Waste Prohibition	• Implemented ordinance during drought
14. Residential ULFT Replacement	• Program in place for low-income multi-family residences.

(1) RMC. *BAWAC Advancements in Water Conservation*. October 2003.
(2) ACWD Staff. April 2004.

The following provides a brief overview of the conservation measures performed in the ACWD service area.

Residential Programs

- **Conservation Kit Distribution Program.** Distribute water efficient plumbing fixtures to SF/MF residents whose homes were built prior to 1992.

- **Residential Clothes Washer Program**. Rebate to individuals who install a qualifying EnergyStar clothes washer in the ACWD service territory.

- **Seasonal Irrigation Postcard Program.** Postcards sent on a seasonal basis to SF residents to update them on current landscape irrigation requirements.

Commercial, Industrial, Institutional (CII) Programs

- **CII Water Use Efficiency Survey Program.** On-site visits to service area businesses to evaluate water use practices and fixtures. Written report of findings and recommendations follows site visit.

- **Commercial ULFT Rebate Program**. Outreach to CII and low-income markets to accelerate rate of toilet replacement. Current $150 rebate is being offered in partnership with USD.

- **Commercial Clothes Washer Rebate Program.** Rebate of $450/$400 offered on the installation of one or more qualifying CEE commercial clothes washer. Current funding includes matching funds from Union Sanitary District (USD) and a grant from the California Public Utilities Commission (PUC).

- **Alameda County Green Business Program.** ACWD participates in the Alameda County Green Business Program, a Commercial, Institutional and Industrial (CII) survey program, which qualifies Alameda County businesses as 'green' or environmentally friendly. ACWD also uses these businesses as a part of the CII Water Use Efficiency (WUE) program.

Large Landscape Programs

- **Dedicated Landscape Partnership.** Large landscape survey and water budget program offered to CII and MF customers with dedicated landscape account. Site surveys measure turf and non-turf and establish an irrigation budget based on square footage and climate conditions. Water use reports are issued to customer and their landscape contractor three times a year; over users are targeted for irrigation system audits

- **Large Landscape Retrofit Program for Schools.** Program targets evaluation, replacement and retrofitting of meters and irrigation systems at service area schools. Funding provided through a matching funds grant with the California Department of Water Resources.

- **California Integrated Management Information System (CIMIS) Weather Station**. Located at Towns Estate Park in Union City, the CIMIS station provides current and historical weather data for the ACWD service area. Data related to ETo is used in ACWD's conservation work and is available to the public through the CIMIS website.

Public Information Programs

- **Avenues for Public Outreach**. ACWD website, Aqueduct newsletter, newspaper advertisements, public appearances.

- **School Education Programs**. Program to work with children in the service area to better equip them for understanding and practicing water conservation techniques.

- **Drought Tolerant Garden**. ACWD's on-site demonstration garden to encourage garden designs that encourage the planting of water conserving plant materials.

- **Customer Service and Conservation Material Distribution.** Handling the public's questions related to all areas of conservation whether in person, via phone or email. Mailing print materials to assist customers in achieving conservation goals.

Other Conservation Activities

- **Leak Detection and Repair.** ACWD's on-going program for evaluating the distribution system for leaks and implementation of necessary repairs to the system.

- **Metering**. All ACWD accounts are metered to account for actual water use by customers.

- **Billing**. Each of ACWD's accounts is billed to the customer based on amount of water used.

- **Customer Service Leak Verifications.** On-going program to alert customers of potential leaks on the customer's property.

2.3 Bay Area Water Supply and Conservation Agency (BAWSCA)

Conservation in the areas served by the BAWSCA agencies is implemented in a coordinated fashion that reflects the uniqueness of the service area. BAWSCA agencies retain primary responsibility for implementing conservation in their service areas and implement a majority of conservation programs independently. In addition, the BAWSCA agencies also take advantage of regional conservation programs that are offered by BAWSCA. BAWSCA agencies located in Santa Clara County also take advantage of programs offered by SCVWD.

BAWSCA's enabling legislation speaks directly to the need for coordinated planning and implementation of a systematic, rational, cost-effective water conservation programs. Effective water conservation programs are one of the key tools available to BAWSCA's members to address the water supply challenges and limitations they face. BAWSCA's FY 2004/2005 conservation program offers three water conservation assistance programs to its agencies on a subscription basis– only those agencies participating in the program pay the costs for the conservation measure(s) they select.

BAWSCA's current water conservation activities were established through a systematic review of candidate water conservation activities and identification of those activities that would be cost-effective, easily administered, and provide the greatest water savings. Centralized program administration and low overhead costs increases cost-effectiveness. Additionally, BAWSCA's accounting system enables agencies to see exactly what each activity costs.

Participants in the BAWSCA conservation program include both large and small agencies. Small agencies are able to take advantage of the administrative resources provided by BAWSCA to implement programs that would not have otherwise been cost-effective or feasible. Large agencies with well developed water conservation programs also take advantage of the assistance program because it allows them to conserve more water at even lower cost.

BAWSCA's FY 2004/2005 conservation program offers its member agencies access to the following regional programs:[5]

- **Bay Area Utility Clothes Washer Rebate Program.** Under this program, eligible water customers can receive rebates of up to $250 following purchase and installation of qualified Energy Star® high efficiency clothes washers which includes the benefit of matching grant funds for rebates from the Department of Water Resources. In 2002, BAWSCA member agencies joined with eight other Bay Area water agencies to offer a single Bay Area program serving 2.7 million residential customers. In 2002-2003, 2,426 rebates were provided to customers in the BAWSCA member agencies' service area. It is estimated that over $160,000 in rebates will be given to customers in FY 04/05.

- **Large Landscape Audit Program.** BAWSCA offers a Large Landscape Audit Program to help conserve water used by commercial, multi-family and residential customers. The program includes services for preliminary landscape water budgets for selected accounts, and actual large landscape surveys to assess landscape watering needs. The surveys include a comprehensive inspection of individual irrigation systems. Customers receive a site-specific irrigation schedule and a water budget prepared to ensure efficient water use, based on landscape square footage, irrigation efficiency and weather conditions. The program also incorporates an ongoing monitoring effort that quantifies and verifies the savings per account over time.

- **"Our Water" School Education Program.** "Our Water" is an innovative curriculum for the fourth grade that combines visual, literary and performing arts instruction with water conservation lessons from the Water Education Foundation's "California Water Story." As children learn valuable lessons in water conservation, they create original works in visual art, poetry, theater, music and dance. At the session's conclusion, children present their works in a live performance where parents and the community can witness their accomplishments. Since 2000, "Our Water" has grown from five schools and 300 children to a total of 12 schools and 800 children for the 2003-2004 school year. In June 2002, "Our Water" received the prestigious "Clair A. Hill Award for Excellence" from the Association of California Water Agencies.

- **Comprehensive Evaluation of Conservation Measures.** In FY 2004/2005, a two part comprehensive evaluation of implementation of conservation measures in the BAWSCA service area is being performed:

    1. **Local Evaluation of Conservation Measures**. In conjunction with SFPUC, BAWSCA agencies have evaluated implementation of 32 conservation measures in their local service areas. This evaluation, performed as part of the Demand Study being done with BAWSCA and SFPUC, is documented in the *Wholesale Customer Water Conservation Potential Technical Report* (URS, December 2004).

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[5] BAWSCA website: http://www.bawsca.org/conserve.html

2. **Regional Evaluation of Conservation Measures**. Building upon the information developed through the local evaluation of 32 conservation measures, BAWSCA will perform a regional evaluation of the conservation measures in the service area. Through this evaluation, BAWSCA and its member agencies will be better able to identify those measures that are better implemented on a regional basis. This information will be used to further define BAWSCA's future conservation program.

A listing of the conservation programs being implemented within the service area of the BAWSCA member agencies is shown below. It is important to note that the design and implementation of individual conservation measures varies throughout the service area, reflecting the unique nature of each community served by BAWSCA members.

Residential Programs

- Water Use Surveys
- Residential "Large Landscape" Surveys/Audits
- Water Waste Ordinances

Commercial & Industrial Programs

- Low Flow Pre-Rinse Spray Nozzles Distribution
- Water Use Surveys (Commercial, Industrial, Institutional)

Hardware/Appliance Rebate Incentives

- Residential and Commercial/Industrial Toilet Replacement Rebates
- Dual Flush (4l) Toilet Replacement Rebates
- Residential Clothes Washer Rebates
- Commercial Clothes Washer Rebates
- Device Distribution/Plumbing Retrofits

Large Landscape Irrigation/Agriculture

- Large Landscape Water Budgets
- Large Landscape Water Surveys/Audits
- ET Controller Rebates
- Artificial Turf Replacement
- Financial Incentives for Irrigation Upgrades

General Public Outreach

- Public Education and Demonstration Projects
- Water Conserving Demonstration Gardens
- Direct Mailers to Customers
- Bill Inserts
- Community Events, Fairs, and Trade Shows
- Conservation Materials (brochures, educational publications)

School Education

- Our Water" – Award winning interdisciplinary conservation education program for 4th grade students
- Water Conservation Poster Contest
- Water "Summer Camp"
- National Theater for Children
- Facilities Tours
- Classroom Visits

Table E6-3 lists the current conservation BMPs being implemented by SFPUC wholesale customers in fiscal year 2004/2005 by customer.

Table E6-3
Current Conservation BMPs Being Implemented by SFPUC Wholesale Customers in FY 2004/2005

SFPUC Wholesale Customer	Res. Water Surveys (BMP 1)	Res. Retrofit (BMP 2)	System Audits, Leaks (BMP 3)	Metering with Commodity Rates (BMP 4)	Large Landscape Cons. Audits (BMP 5)	Water Budgets (BMP 5)	Res. Clothes Washer Reb. (BMP 6)	Pub. Info. (BMP 7)	School Education (BMP 8)	Com. Water Audits (BMP 9)	ULF Toilet/Urinals (BMP 9)	Cons. Pricing (BMP 11)	Conserv. Coordinator (BMP 12)	Water Waste Prohibition (BMP 13)	Res. ULF Toilet Rebates (BMP 14)
Alameda County Water District	NCE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	NCE
Brisbane, City of				✓			✓	✓				✓		✓	
Burlingame, City of			✓	✓		✓	✓	✓	✓	✓	✓	✓			✓
California Water Service Company - Bear Gulch District	NCE	✓	✓	✓			✓	✓	✓			✓	✓	✓	✓
California Water Service Company - Mid-Peninsula District	NCE	✓	✓	✓			✓	✓	✓			✓	✓	✓	✓
California Water Service Company - South San Francisco District	NCE	✓	✓	✓	✓		✓	✓	✓			✓	✓	✓	✓
Coastside County Water District		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Daly City, City of	NCE	✓	✓	✓	✓	✓	✓	✓	✓		NCE	✓	✓	✓	NCE
East Palo Alto, City of		✓	✓	✓			✓	✓	✓			✓	✓		
Estero Municipal Improvement District			✓	✓			✓	✓				✓		✓	✓
Guadalupe Valley Municipal Improvement District				✓			✓	✓				✓		✓	
Hayward, City of		✓	✓	✓			✓	✓				✓	✓	✓	✓
Hillsborough, Town of				✓			✓	✓				✓		✓	
Los Trancos County Water District		✓	✓	✓	E	E	✓	✓	E	E	E	✓	✓	✓	
Menlo Park, City of			✓	✓			✓	✓				✓	✓	✓	
Mid-Peninsula Water District	✓	✓	✓	✓			✓	✓	✓			✓			
Millbrae, City of	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓
Milpitas, City of	✓	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓
Mountain View, City of	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
North Coast County Water District	✓	✓	✓	✓			✓	✓	✓			✓	✓	✓	✓
Palo Alto, City of	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Purissima Hills Water District	✓	✓	✓	✓			✓	✓				✓		✓	✓
Redwood City, City of	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓
San Bruno, City of				✓			✓	✓	✓			✓			
San Jose, City of (portion of north San Jose)	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Santa Clara, City of	✓	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓
Skyline County Water District	✓	✓	✓	✓			✓		E			✓			✓
Stanford University	✓	✓	✓	✓	✓		✓	✓			✓	✓	✓	✓	✓
Sunnyvale, City of	✓	✓	✓	✓	✓		✓	✓	✓	✓		✓		✓	✓
Westborough Water District	✓		✓	✓			✓					✓	✓	✓	✓

SFPUC Wholesale Customer Water Conservation Potential Technical Report, December 2004, p. A-8 - A-9.

NCE = not cost effective today
E = exempt

2.4 Contra Costa Water District (CCWD)

A summary of the CCWD's efforts towards implementing the MOU's 14 water conservation BMPs is presented in Table E6-4.

Table E6-4
Summary of CCWD BMPs[(1)]

BMP	*CCWD Summary*
1. Residential Water Surveys	• Completed over 10,000 single-family residential surveys and over 26,000 multi-family dwelling surveys since 1991.
2. Residential Plumbing Retrofit	• Distributed over 23,000 water-saving devices since 1993.
3. System Water Audits	• 160 miles of service area pipeline is surveyed each year through the leak detection and repair program
4. Metering	• All treated water accounts have been metered since 1940.
5. Large Landscape Programs	• Conducted over 1,300 large landscape surveys since 1991.
6. Washing Machine Rebates	• Over 5,600 high-efficiency water rebates issued since 2000.
7. Public Information Programs	• Program includes exhibits at fairs and home shows, billing inserts, conservation garden, media relations, and newsletter articles.
8. School Education Programs	• Program reaches 40,000 students and several hundred teachers annually. • Program includes providing assemblies, books, contests, posters, teacher grants, teacher training, tours, videos, and water awareness month activities.
9. Commercial, Industrial, Institutional Programs	• Over 1,500 commercial audits completed since 1992. • More than 1,300 commercial ULFTs installed since 2001
10. Wholesale Assistance	• Provides basic conservation services in the wholesale area (ULFTs, water audits, etc).
11. Conservation Pricing	• Uniform price rate structure in place.
12. Conservation Coordinator	• Position staffed since 1991.
13. Water Waste Prohibition	• Adopted Water Waste Prohibition Resolution No. 93-23.
14. Residential ULFT Replacement	• More than 31,000 residential ULFTs installed since 1994.

(1) RMC. *BAWAC Advancements in Water Conservation*. October 2003.

The following provides a brief overview of the conservation measures performed in the CCWD service area.

Conservation Survey Programs

- **Residential Programs.** Since the District started its Water Conservation Program in 1989, the survey program has evolved considerably. In its early years, the program consisted of single family surveys and showerhead distribution. In 1994, the Ultra Low Flow Toilet (ULFT) replacement program was instituted. The program now includes surveys for all customer classes and replacement programs for numerous devices. Both surveys and replacement programs changed to increase the effectiveness of the program and the sustainability of water savings. The Water Conservation Program is comprised of several key elements, each of which targets a specific customer base and satisfies the requirements of specific BMPs.

- **Single Family Surveys.** The program offers free on-site evaluations of home water use. The survey takes between one to two hours to complete, and includes a review of both interior and exterior water use; however, the primary focus of the survey is landscape water use. The surveyor inspects each irrigation station, and notes specific problems and suggested repairs or improvements. Precipitation tests are conducted on individual sprinkler stations, and a site-specific monthly irrigation schedule is prepared. The schedule is programmed into the controller and the customer is taught how to adjust the timer.

- **Multi-Family Surveys.** The Multi-Family Residential Survey program targets apartment complexes and other multi-family customers. The program is marketed to the highest water-using customers and is implemented in conjunction with the MF ULFT Replacement Program. During the survey, plumbing fixtures are flow tested and high-efficiency fixtures are installed or provided to replace high-volume fixtures such as showerheads, faucet aerators and toilet flappers.

- **Commercial, Institutional and Industrial (CII) Surveys.** The CII survey program targets a variety of commercial, institutional and industrial customers. Individual water-using devices are inspected, and customers receive a report listing improvements that can be made to the equipment and to the maintenance of that equipment. Rebates are offered as an incentive to upgrade to more efficient equipment.

- **Large Landscape Surveys.** The Large Landscape Survey Program targets the highest landscape water users among commercial, institutional or multi-family customers. The survey includes an inspection of the irrigation system and sprinkler precipitation tests on individual stations. A site-specific irrigation schedule is then prepared for the property. Additionally, a report is prepared listing equipment improvements, irrigation schedules, and management changes that would result in more efficient water use. Sites with inefficient irrigation timers or other inefficient irrigation devices are encouraged to participate in the irrigation upgrade program.

Conservation Incentive Program

- **Residential ULFT Voucher/Distribution Program.** Since 1994, CCWD has offered a ULFT Rebate program for single family customers. This long running program has finally ended and has been replaced with a new and even more effective program. In FY04, CCWD replaced the Residential ULFT Rebate Program with a ULFT Voucher/Distribution Program. Switching to a Voucher/Distribution Program has: 1) reduced the number of participants who did not need an incentive to prompt them to replace their toilet; 2) reduced check processing costs; and 3) assured that customers receive a high-quality toilet they will be satisfied with for years.

  The program targets pre-1992 single family and multi-family housing. Eligible customers receive a voucher and pick up their new ULFT at a specific vendor who contracts with the District. Customers are responsible for installation and the District conducts random inspections to insure proper installation. Multi-family customers who replace more than six toilets receive free delivery.

- **CII ULFT Replacement Program.** The program targets various commercial and institutional customers either through direct mail, bill inserts, or through the CII Survey Program. Customers are offered a rebate of 100% of the material cost up to $150 per ULFT. In addition, the District negotiated with local plumbing wholesalers to offer select high quality toilets at wholesale prices to any participant. This assured that toilets installed will have long-term savings and customer satisfaction.

- **Residential High Efficiency Clothes Washer Rebate Program**. The District, along with six other water agencies, implemented a Bay Area Regional Clothes Washer Rebate Program. This program offers a two-level rebate of $50 and $100 to encourage customers to purchase the best of the high efficiency machines. The program is marketed primarily at the retail appliance stores. In addition, the District markets the program through the CCWD bill insert and through the Single Family Survey Program.

- **Rinse & Save - Pre-Rinse Spray Nozzle Replacement Program.** The Rinse & Save program is part of a statewide program implemented by the California Urban Water Conservation Council (CUWCC). The program offers and installs free pre-rinse nozzles in restaurants and other food industry businesses.

- **Light Wash- Commercial High Efficiency Clothes Washer Rebate Program**. The Light Wash program is part of a PG & E service area program implemented by Energy Solutions, the program administrator. The program offers $350 rebates to install commercial grade high efficiency clothes washers in apartment common laundry facilities and in commercial laundromats. Both the program administrator and the District market to customers and washer suppliers through direct mail.

- **Commercial Equipment and Irrigation Upgrade Rebates.** In conjunction with the Commercial and Large Landscape Survey Programs, rebates are offered for select plumbing equipment to encourage customers to upgrade to more efficient water fixtures. The program includes rebates for urinals, cooling tower retrofits, and other water-using fixtures. For landscape water use, the program offers rebates for irrigation timers, sprinkler-to-drip retrofits, rain sensors, and sprinkler head upgrades. Pre- and post-inspections are conducted, and rebates are provided based on the material cost of the equipment.

Other Programs

- **Large Landscape Water Budgets.** The Landscape Water Budget Program is directed at those commercial and multi-family sites with dedicated irrigation water accounts. There are approximately 1,200 such accounts in the Treated Water Service Area (TWSA). Water Budgets are prepared using real-time local evapotranspiration (ETo) data and actual landscape areas measurements from an aerial photo. The data is integrated into a detailed water budget equation, which integrates monthly landscape co-efficients, irrigation efficiency, and real-time ETo. Water Budget site reports are prepared comparing the water budget to actual water use. The program provides participating commercial and multi-family customers with water budget site reports tailored specifically to their properties.

These reports enable the customer to adjust their water use to reflect seasonal weather changes and therefore control the costs of their water bills.

- **Green Business Program**. The Green Business Program is a partnership of environmental agencies, professional associations, waste management agencies, utilities, and a concerned public, working together to recognize and assist business and government agencies that operate in an environmentally friendly manner.

  As part of the program, the Contra Costa Water District evaluates businesses for water use efficiency. Customers receive conservation surveys and are offered incentives to upgrade equipment. The District provides survey findings to the Contra Costa Clean Water Program, the lead agency for the Green Business Program.

- **Public Information Program.** The CCWD Public Information Office coordinates with the Water Conservation Office to promote water conservation messages and programs through a variety of media. Publications, website pages, presentations, booths at community events, direct mail pieces, newsletters, newspaper ads, and water education programs are all tools used to promote water conservation. Along with printed materials and the CCWD website, the Public Information and Conservation Department staff educational booths at a number of community events including; home and garden shows, county fairs, KidFest festival, earth day events, and others. In addition the Department offers speakers to local organizations and community groups. Finally, the Department sponsors the *Kids in Gardens Teacher Workshops* through the Aquatic Outreach Institute.

- **Water Education Program.** The goal of the Water Education Program (WEP) is to teach children the importance of water in our lives. CCWD's WEP educates service-area school students about CCWD's mission to deliver clean, safe water in an environmentally responsible manner. All of the programs promote and reinforce the following goals: recognizing activities that could affect water quality; understanding the connection between health and water quality; understanding the biodiversity of a watershed; and the importance of water conservation.

2.5 East Bay Municipal Utility District (EBMUD)

A summary of EBMUD's efforts towards implementing the MOU's 14 water conservation BMPs is presented in Table E6-5.

Table E6-5
Summary of EBMUD BMPs (1,2)

BMP	*EBMUD Summary*
1. Residential Water Surveys	• Surveys have been offered since 1987. • Conducted over 2,280 residential surveys in FY 2003 • Distributed over 7,000 self audit kits in FY 2003. • Initiated Residential Landscape rebate program in 1998. Over 750 homeowners have participated in the program.
2. Residential Plumbing Retrofit	• Distribution of water-saving devices has been on-going since the 1980's. • Nearly 5,000 devices were distributed in 2001.
3. System Water Audits	• A distribution system leak detection and pipe replacement program has been in place since 1961.
4. Metering	• Connections have always been metered.
5. Large Landscape Programs	• Conducted over 156 irrigation audits in 2001.
6. Washing Machine Rebates	• Washer rebate program in place since 1996. • Over 25,000 rebates issued to date.
7. Public Information Programs	• Program includes workshops, presentations, participation in community events and professional trade shows, business awards, and public advisory committees.
8. School Education Programs	• A school education program has been in place since 1974. • Over 1.5 million students have received material and training to date.
9. Commercial, Industrial, Institutional Programs	• CII surveys have been offered since 1992. • 160 CII accounts were audited in 2001. • Commercial washer rebate program initiated in 2001. 157 rebates were issued in FY 2003 • District toilet installation program initiated in 2001. • 839 installations of commercial dishwasher spray valves in FY 2003.
10. Wholesale Assistance	• Not Applicable.
11. Conservation Pricing	• Increasing block rate structure in place for single-family residential customers.
12. Conservation Coordinator	• Position has been staffed since 1989.
13. Water Waste Prohibition	• Water waste prohibitions in place since 1977.
14. Residential ULFT Replacement	• Rebates for ULFT offered since 1995. • Over 35,000 rebates/installation provided to date.

(1) RMC. *BAWAC Advancements in Water Conservation.* October 2003.
(2) EBMUD. *Water Conservation & Recycling.* FY 2003 Annual Report.

The following provides a brief overview of the conservation measures performed in EBMUD's service area:[6,7]

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[6] RMC. *BAWAC Advancements In Water Conservation.* October, 2003.
[7] EBMUD. *Water Conservation & Recycling.* FY 2003. Annual Report.

Residential Programs

EBMUD's Residential Water Saving Programs represent an array of incentives and educational efforts designed to serve a diverse customer base. To improve the effectiveness of the residential water survey programs, outreach efforts have been increasingly focused on the larger water user with greater potential water savings. Identifying water savings potential among the 325,000 residential customers is primarily accomplished through queries of seasonal water consumption data. Direct mail has remained the single most effective tool in enlisting customer participation in water surveys. Specific residential conservation measures include:

- **Water Use Surveys (Single Family, Multi Family).** Both outdoor and indoor surveys assess irrigation systems and home appliances and customers are given educational materials and recommendations for improving water use efficiency.

- **Water Waste/Leak Detection Surveys.** Through responding to customer reports of over-watering and visually identifying leaks, EBMUD helped save more than 18,000 gallons of water a day in 2003.

- **Student Surveys and Retrofits.** The District works with educators to help students learn about water conservation while surveying and retrofitting schools and homes.

- **Self-Audit Kits.** Free water-saving kits are distributed to residential users upon request, at community presentations, workshops, festivals and through direct mailings.

- **Residential Landscape Rebate Program**. EBMUD offers rebates of up to $1,000 to single family homeowners who convert their high water-use gardens into water-conserving landscapes.

- **Residential Landscape Workshops.** In 2003 three workshops focused on the role of soil and design principles in water-conserving gardens.

Hardware/Appliance Programs

- **Device Distribution.** EBMUD distributed free water-saving devices such as faucet aerators, showerheads, and toilet retrofit hardware.

- **Residential Clothes Washer Rebates.** In partnership with neighboring utilities, EBMUD offered customers rebates of up to $150 for high-efficiency clothes washers.

- **Toilet Replacement Rebates.** EBMUD maintains a two-tiered rebate program where $25 or $100 is offered for installing high-efficiency toilets.

Large Landscape Irrigation Programs

- **Landscape Irrigation Upgrade Program.** This program provides financial incentives processed as credits on customer water bills that range from 50%-100% of eligible costs of equipment.

- **Incentives**. EBMUD provides a variety of incentives to reduce irrigation water use including distributing free water-efficient flow-control devices, providing customized rebates and installing commercial dishwashing spray valves.

- **Model Landscape ordinances.**

General Public Outreach

- **WATERSTAR™ Conservation Certification and Product Labeling Program**. Starting in 2004 EBMUD began implementing this program to inform retailers in the health, food service, and cleaning operations sectors as well as residential customers of the best available water conservation technology.

- **Public Education and Demonstration Projects (5).** EBMUD maintains several public interactive demonstration projects to allow the public to learn and understand the importance of fire resistant and water-efficient gardens.

- **Workshops.** EBMUD led workshops at the following events: Automatic Rain/Horizon Irrigation Turf Days, Pleasanton Turf Days and Alameda County Master Gardeners Training Class.

- **Community Events and Trade Shows (37).** EBMUD participated in a various community events including California Native Plant Society, Oakland Civic Pride Fair and the Castro Valley Fall Festival.

- **Publications (new and updated).** EBMUD develops various brochures, reports and information sheets to inform the public of conservation news. In addition, EBMUD collaborates with other organizations to create and distribute publications including Sunset Magazine and LifeGarden.

- **Outreach**. EBMUD actively promotes and manages outreach through committees and marketing efforts. In addition, they have been recognized for their work though various conservation awards.

    - Marketing
    - Water Conservation Achievement Awards (3 awards in FY 02)
    - Public Advisory Committees
    - Demand Management Advisory Committee
    - Landscape Advisory Committee

School Education Programs

- **School Garden Program**. EBMUD partners with a local non-profit to support local school garden projects through workshops.

- **Project W.A.T.E.R.** Since 1974 EBMUD has provided water conservation curricula and supplemental materials to teachers and students.

- **National Theater for Children.** This program delivers environmental messages to elementary school children through dramatic performances. In the 2002-2003 school year more than 43,000 performances were given.

- **Garden Grant Awards (20 awards in FY 01&02).** EBMUD provides grants for $500 to $2,000 to local schools to implement water-conservation garden projects.

Commercial, Industrial, Institutional Programs

EBMUD's Non-Residential Water Saving Programs provide EBMUD business customers with a broad range of tools and services to improve water use efficiency. Services include free site surveys, water conserving device distribution, technical consultations, plan review, cost-benefit analyses, and financial incentives. Key account representatives work with customers with larger water use to improve access to the range of services offered by EBMUD. Coordinated efforts within EBMUD departments, with business leaders, and through external service providers have resulted in increased participation by the larger and more difficult to reach customers. Examples of non-residential conservation measures include:

- **Commercial Water Use Surveys**. Surveys consist of a free on-site visit by staff to identify opportunities for upgrading existing water systems.

- **Industrial Water Conservation/Wastewater Study.** This study examined the effects of using high-efficiency nozzles for wash-down operations and identified the lowest allowable flow rate for the nozzles with water savings of 50,000 gallons per week.

- **Customized Rebates.** EBMUD offers customized rebates that may off-set costs of improving water-use efficiency by up to 50%.

- **Commercial Dishwashing Spray Valve Installation.** This program has provided the direct installation of over 800 water-efficient spray valves used at dish washing stations.

- **Toilet Replacement Program**. This program targeted non-profit businesses and provided the installation of ultra-low-flush toilets at no cost.

- **Commercial Clothes Washer Rebates.** EBMUD participated in "Light Wash" a statewide clothes washer retrofit rebate program offering rebates for clothes washers in multi-family housing units, businesses and coin laundry stores.

- **Green Business certification, StopWaste partnership.** A project of the Alameda County Waste Management Authority, StopWaste targets larger industries for assessments to help implement environmental solutions.

Special Projects and Research

- **Irrigation Reduction Information Systems (IRIS).** IRIS is a water landscape budget management system that provides customers with important data to assist with managing irrigation and using less water.

- **Research.** EBMUD has conducted a number of research studies to assess conservation devices and practices to further refine and improve their projects. Some of these research initiatives are listed below:
  - Residential End Use Study
  - National Multi Family Submetering Study
  - Toilet Performance Testing
  - Oakland Zoo Conservation and Recycling Feasibility Study
  - ET Controller Pilot Study
  - Market Penetration Study
  - Pre-rinse Spray Nozzles
  - Industrial Conservation Potential
  - Oakland Zoo Water Use Efficiency Study
  - X-Ray Processor Recycling Technology
  - Participation in performance testing at NAHBRC (Maryland)
- **Web Enabled Services**. EBMUD aims to web-enable all customer interactions by 2006. Online water conservation services currently being considered or in development include:
  - Online Consumption Information
  - Online Rebate Applications
  - Interactive tools (plant databases, ET calculators)
  - Automated services

2.6 San Francisco Public Utilities Commission (SFPUC)

The SFPUC implements water conservation in its in-City retail service area. A summary of the SFPUC's retail efforts towards implementing the MOU's 14 water conservation BMPs is presented in Table E6-6.

Table E6-6
Summary of SFPUC Retail Service Area BMPs

BMP		***SFPUC Summary***
1.	Residential Water Surveys	• Incentive program in place since 1920s to promote identification and repair of leaks. • Surveyed 16,640 single-family accounts (15%) and 12,352 multi-family accounts (34%) since 1988.
2.	Residential Plumbing Retrofit	• Passed ordinance in 1990 requiring water-conserving devices (i.e., 3.5 gallon per flush toilets) be installed in new buildings. • Passed ordinances in 1991 requiring water conservation device retrofits (i.e., 3.5 gallon per flush toilets) within residential and commercial buildings upon sale, transfer of title, or major improvement. • According to customer filed affidavits, 91% of all subject property has been retrofitted, and 98% of the municipal buildings have been retrofitted with 3.5 gallon per flush toilets to date. • Passed ordinance in 2000 requesting the Board of Supervisors amend the Municipal Housing Code requiring retrofit with 1.6 gallon per flush toilets upon sale, transfer of title, or major improvement.
3.	System Water Audits	• System-wide leak inspection and repair program implemented in 1970s. • Now using sophisticated electronic equipment, which can detect leaks from above ground.
4.	Metering	• All accounts have been metered since 1916. • Accounts billed by volume of use.
5.	Large Landscape Programs	• Passed ordinances in 1991 and 2000 which places limitations on landscaping for lots with landscaping areas greater than 1,000 square feet. • Conducted 3,200 irrigation surveys for all large irrigation accounts. • Installed two California Irrigation Management Information System (CIMIS) weather stations.
6.	Washing Machine Rebates	• Began a $75 water rebate program in 1999, and distributed 517 rebates to date.
7.	Public Information Programs	• Program includes brochures, public service announcements, radio spots, newspaper ads, and posters, billing inserts, direct mailings, and presentations. • Sponsors various public outreach activities and offers presentations and seminars on water conservation topics. • Water conservation literature available for public distribution.
8.	School Education Programs	• Program includes classroom presentations (reaching 14,000 students a year), environmental grant program, and “Water Play Day” at the Randall Junior Museum.
9.	Commercial, Industrial, Institutional Programs	• Conducted conservation audits on 12,873 accounts (approximately 60%) since 1989. • Passed ordinance in 1999 requiring all municipal buildings to undergo water-efficient plumbing retrofit. • All new commercial and industrial buildings are inspected to confirm water-efficient plumbing, recirculating cooling towers, etc.
10.	Wholesale Assistance	• Developed Interim Water Shortage Allocation Plan with BAWUA, which removes disincentives for developing water conservation. • The SFPUC has a wholesale conservation coordinator that provides technical assistance to its wholesale customers in meeting the BMPs.
11.	Conservation Pricing	• Implemented a two-tier rate structure to encourage plumbing retrofits.
12.	Conservation Coordinator	• Conservation coordinator position has been staffed since 1986.
13.	Water Waste Prohibition	• Section D of SFPUC’s Rules and Regulations for Water Service includes a provision for water waste prohibition.
14.	Residential ULFT Replacement	• ULFT Program in place since 1995. 58,090 toilets have been replaced to date. • Sponsors “toilets for $10” program which offers high quality, water efficient toilets for $10. Over 28,000 toilets have been replaced.

The SFPUC is currently revamping its retail conservation program. As part of this effort, the SFPUC is evaluating the cost-effectiveness of 42 conservation measures to be considered for future implementation. Historically, the SFPUC's retail conservation program has focused on residential water use. The conservation measures being evaluated for future implementation have a greater focus on non-residential uses.

The majority of the SFPUC's wholesale customers also implement the MOU BMPs. Their efforts are described in the Section 2.2 of this TM. In addition, the SFPUC, in conjunction with its wholesale customers and BAWSCA, conducted an evaluation of potential conservation within the wholesale customer service areas. This study considers the cost-effectiveness of implementing 32 various conservation measures by the individual wholesale customers.

The following is a brief overview of the conservation measures in the SFPUC retail service area.

Residential Programs

- **Single and Multi-Family Water Use Surveys.** Free interior and exterior water audits identifying and repairing leaks.

- **Residential Plumbing Retrofit Ordinance.** Requires water conservation device retrofits within all new or existing residential buildings upon sale, transfer of title, or major improvements.

- **Residential High Efficiency Washer Rebate Program**. A $75 washer rebate program limited to one rebate per property.

- **ULFT Rebate Program.** Up to $50 rebate per toilet to individuals who purchase a ULFT.

- "**Toilet for $10" Program.** High quality and water efficient toilets are selling for only $10 by SFPUC.

Large Landscape Conservation Programs

- **Citywide Ordinance Limiting Water Use on Landscaping Areas.** Various landscaping requirements aimed towards water conservation on large landscaping areas greater than 1,000 square feet.

- **Large Landscape Irrigation Account Surveys**. Inspector surveys the irrigation system to identify inefficient water application and leaks.

- **Large Landscape Irrigation Water Budgets**. Voluntary water budget account included on each water bill.

- **Ground Keeping Training Seminars.** Yearly training seminars instructed by local experts for the City's groundkeepers.

- **CIMIS Weather Stations.** San Francisco installed two CIMIS Weather Stations. One of the sites is in the city's largest residential neighborhood and the other is located on the east side of the city. Weekly evapotranspiration data is made available on a Web Page for the public to aid in irrigation scheduling.

Commercial Programs

- **Commercial and Industrial Users Surveys.** Water audit program to identify and repair leaks in commercial and industrial buildings.

- **Municipal and Institutional Buildings Plumbing Retrofit Ordinance.** Requires all municipal and institutional buildings, which include 2,200 San Francisco City Department buildings, to replace their plumbing with water-efficient plumbing fixtures.

- **New Commercial and Industrial Water Use Review.** Before receiving a certification of occupancy, all new commercial and industrial buildings must have an inspection by an inspector from the Department of Building Inspection verifying the use of water-efficient plumbing fixtures.

Public Outreach Information Programs

- Direct Mailers
- Conservation Materials (brochures, education publications)
- Public Seminars and Presentations on Water Conservation Topics
- Public Service Announcements
- Radio Spots and Newspaper Ads
- Bus interior Posters
- Bill Inserts
- Fairs and Shows
- Education Videos

Water Education Programs

- **Environmental Education Program.** Offers presentations to teachers and students about how San Francisco gets its water and other environmental issues.

- **Environmental Grant Program.** Offers grants of up to $1,000 to high school classes and student groups to work on projects exploring an aspect of water conservation or pollution prevention.

- **"Water Play Day".** Takes place in the city's children museum and educates pre-schoolers and students in early primary grades about water.

- **Water Conservation Calendar Contest.** A calendar design contest for third, fourth, fifth and sixth graders. The contest encourages students to think about water conservation.

Other Conservation Activities

- **Metering Policy**. All of San Francisco's retail customers have been metered and are billed by the amount of water they use. Sewer charges are also billed based on the amount of water that they use.

- **System-Wide Leak Inspection and Repair Program**. Uses sophisticated electronic equipment that can detect leaks from above ground to identify and repair leakage in the distribution system.

- **Wholesale Agency Assistance.** The SFPUC has a wholesale conservation coordinator that provides technical assistance to its wholesale customers in meeting the Best Management Practices (BMPs).

- **Conservation Pricing/Two-Tier Rate Structure Program**. Retail customers who have retrofitted their plumbing fixtures and have filed an affidavit as to that action are billed at the normal rate per volume. Those customers that have not retrofitted their plumbing fixtures are charged a rate 50 percent higher than the normal rate.

- **Water Waste Prohibition**. Section D of the SFPUC's Rules and Regulations for Water Service enacted numerous water use restrictions and prohibitions in response to the severe water shortage. Violation of any water use restriction may result in flow-restriction or termination of service.

2.7 Santa Clara Valley Water District (SCVWD)

A summary of the SCVWD's efforts towards implementing the MOU's 14 water conservation BMPs is presented in Table E6-7.

Table E6-7
Summary of SCVWD BMPs (1,2)

BMP		SCVWD Summary
1.	Residential Water Surveys	• Offers residential surveys on behalf of its retailers, with the exception of San Jose Water Company. • Completed over 13,000 residential surveys since 1998 (not including surveys completed by San Jose Water Company).
2.	Residential Plumbing Retrofit	• Since 1992, has distributed over 118,000 low-flow showerheads and over 72,000 aerators to residents free of charge through the water retailers, residential water audits, and public events.
3.	System Water Audits	• Distribution system audit and leak detection program in place since 1991.
4.	Metering	• All connections are metered and billed by volume of use.
5.	Large Landscape Programs	• Landscape water audits offered through the Irrigation Technical Assistance Program. • Over 540 audits conducted since 1995.
6.	Washing Machine Rebates	• Offers washer rebates in conjunction with PG&E since 1995. Over 33,000 rebates have been issued since 1995.
7.	Public Information Programs	• Program includes water conservation materials, participation in community events, multi-media campaigns, water conservation workshops and seminars. • Employs 10 professional staff to provide outreach related to water conservation. • Hosts industry-specific workshops that draw many businesses/corporations throughout the County. • Co-sponsors awards to businesses that implement environmental programs.
8.	School Education Programs	• Provides free classroom presentations, puppet plays, and tours of District facilities. • Provides workbooks and videos, as well as hands-on training to teachers.
9.	Commercial, Industrial, Institutional Programs	• Co-sponsors program with City of San Jose to provide financial incentives for CII accounts to implement permanent water reduction measures. • Replaced 8,900 toilets in CII sites since 1992. • Offers rebates up to $450 for replacement of high-efficient clothes waters in laundromats.
10.	Wholesale Assistance	• Provides resources to administer all MOU BMPs.
11.	Conservation Pricing	• Bills by volume of use.
12.	Conservation Coordinator	• Position staffed since 1990.
13.	Water Waste Prohibition	• Developed water use restrictions in 1989 and 1993 to assist water retailers in the development of water waste prohibitions.
14.	Residential ULFT Replacement	• Provided incentives for the retrofit of 244,000 residential toilets since 1992. • Expected to complete BMP targets in FY 2003.

(1) RMC. *BAWAC Advancements in Water Conservation*. October 2003.
(2) SCVWD. *Water Use Efficiency Program.* Annual Report, FY 2002-2003.

The following is a brief overview of the conservation measures in the SCVWD retail service area.

Residential Programs

- **Water Wise House Call Program.** The SCVWD has been providing free residential surveys since 1998.

- **Plumbing Retrofits.** The SCVWD has been installing and/or distributing free faucet aerators and low-flow showerheads since 1992.

- **Residential High Efficiency Washer Rebate Program.** The SCVWD has been offering rebates since 1995.

- **ULFT Rebate Program.** The SCVWD has been offering incentives for ULFTs since 1992. SCVWD is currently offering free ULFT installation for elderly, disables, and/or low income residents.

- **Water-Efficient Landscaping Workshops for Homeowners.** Since 1993, the SCVWD has been offering an annual series of Saturday morning landscaping workshops for homeowners in Santa Clara County.

Large Landscape Conservation Programs

- **Irrigation Technical Assistance Program (ITAP).** The SCVWD offers free on-site evaluations for large landscape managers.

- **Landscape Irrigation Workshops for Professionals.** Each year the SCVWD co-hosts a two-day workshop for landscape professionals on Landscape Irrigation Auditing, a one-day workshop on Water Budgeting, and a one-day workshop for landscape contractors.

- **CIMIS weather station.** This free service provides current reference crop ET data to help managers of nurseries, golf courses, parks and agricultural cropland, and other areas with irrigation scheduling decisions.

Commercial Programs

- **Commercial Clothes Washer Rebate Program.** Incentives for efficient washing machines.

- **Pre-rinse Sprayer Program.** Replaces inefficient dish sprayers with state-of-the-art nozzles with savings of ~ 200 gallons of water per unit per day.

- **Water Efficient Technologies (WET) Program.** Offers rebates to commercial, industrial and institutional customers for making process and equipment changes which reduce water use. Program has been expanded to include commercial, industrial and institutional water customers.

Public Outreach Programs

- **Outreach Publications.** The SCVWD produces a variety of water efficiency publications, such as the *Rules of Thumb for Water-Wise Gardening* and the *Lawn Watering* guide.

- **Outreach Events.** The SCVWD promotes water conservation at community events with hands-on displays, educational handouts and free device distribution.

- **Water Conservation Hotline.** The SCVWD maintains a Water Conservation Hotline, as well as a Water Conservation web site.

- **Pre-rinse Sprayer Program.** Replaces inefficient dish sprayers with state-of-the-art nozzles with save ~ 200 gallons of water per unit per day.

Research and Studies

- **Baseline Study.** This comprehensive survey will provide the specific data needed to write the Water Use Efficiency Master Plan and streamline the District's water use efficiency programs for effective long-term water conservation.

- **Landscape and Agricultural Area Measurement and Water Use Budgets Study.** The SCVWD has begun conducting aerial flyovers over the county to gather multi-spectral images showing landscape and agricultural areas by parcel.

- **Mobile Home Submeter Pilot Program.** Over the last three years, the SCVWD has equipped five large mobile home parks with submeters, replacing one-meter systems in which residents in the same complex split water costs evenly, with submeters at each unit.

- **Dedicated Landscape Meter Program.** The SCVWD provided submeters to three large landscape property owners, which allowed them to monitor water used in the site's irrigation systems.

- **Hot Water Recirculation Pump Study**. This SCVWD study, completed last year, evaluated a device, which is installed under the sink to provide instant hot water at the push of a button.

- **Four-Liter Ultra-Low-Flush Toilet Study**. The SCVWD was one of several agencies around the state, which participated in this study to evaluate the effectiveness of a new toilet fixture.

2.8 Zone 7 Water Agency (Zone 7)

A summary of Zone 7's efforts towards implementing the MOU's 14 water conservation BMPs is presented in Table E6-8.

Table E6-8
Summary of Zone 7 BMPs (1,2)

BMP		Zone 7 Summary
1.	Residential Water Surveys	• Not Applicable. BMP is implemented by Zone 7's retailers.
2.	Residential Plumbing Retrofit	• Not Applicable. BMP is implemented by Zone 7's retailers.
3.	System Water Audits	• Conducts monthly audits of water production records. • System-wide leak detection program implemented if losses are excessive.
4.	Metering	• All accounts are metered and billed by volume of use.
5.	Large Landscape Programs	• Conducted irrigation workshops. • Partially Funded landscape audit conducted by retailing agency. • Future installation of CIMIS Weather Station.
6.	Washing Machine Rebates	• Coordinates washing machine rebate program on behalf of retailing water agencies. • 5,600 rebates issued since 1998.
7.	Public Information Programs	• Program includes participation in public events, advertisements, presentations, and educational displays.
8.	School Education Programs	• Program includes furnishing of water conservation materials to local schools, facility tours and videos.
9.	Commercial, Industrial, Institutional Programs	• Not Applicable. BMP is implemented by Zone 7's retailers.
10.	Wholesale Assistance	• Provides funding to promote water conservation efforts of Zone 7's retailers.
11.	Conservation Pricing	• Commodity rates included in charges.
12.	Conservation Coordinator	• This position has been staffed since 1992.
13.	Water Waste Prohibition	• Efficient use of water required by water contracts with retailing water agencies.
14.	Residential ULFT Replacement	• Over 11,000 ULFT rebates have been issued since 1994.

(1) RMC. *BAWAC Advancements in Water Conservation*, October 2003.
(2) Zone 7 staff, April 2004.

The following provides a brief overview of the conservation measures performed in the Zone 7 service area.

Hardware and Appliance Incentives

- Toilet Replacement Rebates
- Residential Clothes Washer Rebates
- Device Distribution (Low-Flow Shower Heads, Faucet Aerators)

Residential Programs

- Water Use Surveys
    - Single family
    - Multi-family
- Water Waste Prohibitions

Commercial Irrigation Programs

- Water Use Surveys/Irrigation Water Budgets
- Irrigation Rebate Program
- Installation of CIMIS station

School Education

- Purchase and distribution of curricula materials for teachers and students
- Water Conservation Poster Contest in Dublin and Livermore Schools
- Facilities Tours
- Classroom Visits

Outreach

- Alameda County Fair Water Education Booth
- WaterWise Gardening CDROM
- Drought Tolerant Demonstration Garden
- Publications and Videos
- Community Events (Farmers' Markets, Creek Clean-up, Earth Day)

Wholesaler Assistance

- Bi-Monthly Coordination Meetings with Retailers
- CIMIS Station Coordination
- Continued Financial/Technical Assistance on Future Programs (CII ULFT Rebate Program, Large Landscape Rebates)

Possible New Programs / Approaches

- Residential Landscape Rebate Program ***(Proposed for FY 2004)***

- Possible Commercial ULFT Replacement Program
- Irrigation Controller Distribution
- On-Line Rebate Application Processing
- Enhanced Public Outreach Efforts, i.e. Water Efficient Landscaping Videos
- Landscape Irrigation Workshops for Professionals
- Increased Use of the Website for Water Efficient Landscaping Efforts
- Pre-Rinse Sprayer Distribution/Installation Program

In summary, the participating agencies are effectively implementing BMP's individually tailored to meet the characteristics of their customers and service areas. In addition, agencies are investigating new approaches and programs to enhance current conservation efforts. Section 3.0 details potential areas for additional future water conservation in the Bay Area and measures agencies may take on a local level to further conserve water.

3.0 Future Water Conservation Potential

The participating agencies are committed to building on the success of their past water conservation efforts. Capitalizing on the knowledge and experience of each member, and the recent breakthroughs in technology, innovation and interagency cooperation, the agencies are poised to pursue future conservation opportunities. Although each agency has developed conservation initiatives to meet unique service area needs, commonalities between conservation programs exist. Potential regional water savings that could be realized through synergies amongst agencies are highlighted in the following paragraphs. Subsequently, future conservation markets at each agency are described. Additional CALFED assistance described in Section 6.0 could accelerate these types of activities.

3.1 Future Conservation Potential in the Study Area

The Bay Area is committed to aggressively advancing water conservation programs in the future. Additional water savings may be possible through:

- New conservation programs that improve water use efficiency in residential and commercial markets based on:
    - Improving distribution and use of water saving devices such as self-adjusting ETo sprinkler timers
    - Continuing and expanding conservation education efforts through school curriculum development, informational newspaper and radio campaigns, and public brochures
    - Budgeting water through landscape irrigation programs that track water use and offer suggestions for further water savings

- Technological advances in water conserving devices
- Increased knowledge of and responsiveness to customers' water use behaviors
- Increased commitment from local and state agencies and lobbying for additional conservation funding
- Expanded reinforcement of water conservation awareness

Participating agencies predict continued water savings in the future. Figure E6-2 on the following page illustrates projected cumulative savings of more than 180,000 AF of conservation savings by 2020.

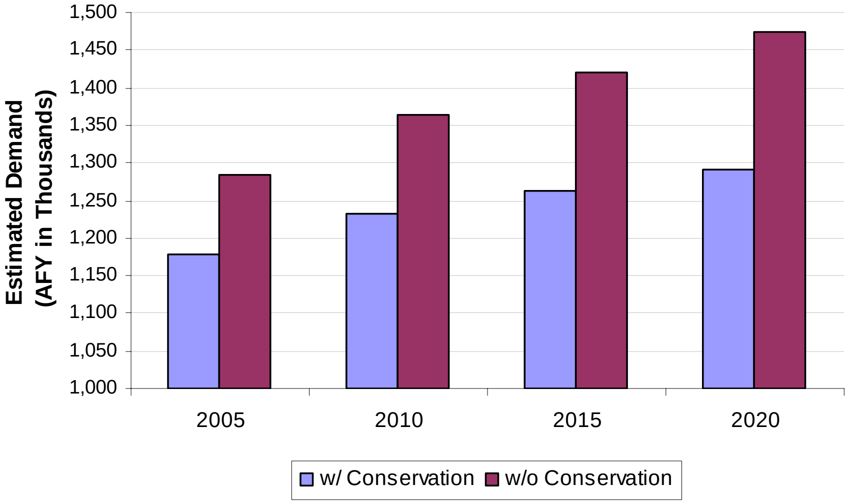

Figure E6-2
Projected Conservation Related Savings[8]

The following paragraphs describe specific water conservation markets for the future in each of the participating agencies' service areas.

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[8] It should be noted that the figure above includes a placeholder water savings estimate for BAWSCA. This information may change as results from an ongoing study of the potential for conservation savings by BAWSCA members are made available.

3.2 ACWD Water Conservation Market

Water conservation was identified in ACWD's 1995 Integrated Resources Planning Study (IRP) as a key part of ACWD's cost-effective strategy to meet both long-term water supply demands and peak monthly production capacity requirements. Since then, ACWD has maintained a structured approach to conservation planning, targeting the most cost-effective conservation measures to achieve the demand reduction goals outlined in the IRP.

Some of ACWD's targeted savings will be met through existing BMPs, however some of the BMPs are not cost-effective in the ACWD service area. ACWD intends to continue to make cost-effective conservation programming decisions on the basis of current technology, legislation, new BMPs, and availability of funding. Due to continuing advancements in water conservation, ACWD cannot say today what the best means of achieving this goal will be tomorrow. As originally identified in the IRP, outdoor water use continues to be the most effective area for ACWD to achieve demand reductions. A number of promising programs currently being considered by ACWD include enhanced use of weather-based irrigation controllers, use of GIS and remote sensing techniques to help customers improve irrigation efficiency and additional financial incentives for customers to improve water use efficiency through retrofits and conversion to drought tolerant landscaping. In addition, ACWD will continue to track advances in technologies for residential and CII indoor water use efficiency such as advances in plumbing fixtures and onsite water reuse.

3.3 BAWSCA Water Conservation Market

BAWSCA's enabling legislation speaks directly to the need for coordinated planning and implementation of a systematic, rational, cost-effective water conservation programs. Effective water conservation programs are one of the key tools available to BAWSCA's members to address the water supply challenges and limitations they face.

BAWSCA's goals are a reliable supply of high quality water at a fair price. BAWSCA and its member agencies recognize the important role of conservation in long range water resources planning to meet the identified water supply needs for customers in the service area.

A key activity for BAWSCA in the coming years will be the successful implementation of SFPUC's Capital Improvement Program. An important element of the CIP implementation will be a Program Environmental Impact Report, which will analyze the environmental impacts of the CIP and alternatives to the preferred program. In preparation for conducting the PEIR, SFPUC, BAWSCA and its 28 agencies have evaluated the local cost-effectiveness of 32 different water conservation measures. In addition, BAWSCA is independently evaluating the increased cost-effectiveness of implementing water conservation measures regionally through BAWSCA. The results of these studies will be used to help identify future conservation activities in the service area. Through these processes, BAWSCA and its agencies will continue to implement those costs-effective conservation programs, which offer true value to the water customers and the community.

3.4 CCWD Water Conservation Market

Water conservation is an integral component of CCWD's 1996 Future Water Supply Study (FWSS), which identified CCWD's plans to provide customers a high quality, reliable supply of water for the next 50 years. The FWSS expanded CCWD's existing conservation program to encompass wholesale and retail customers. Since 1996, CCWD has implemented all BMPs at levels consistent with or above the requirements of the CUWCC MOU for Urban Water Conservation.

During the past few years, CCWD has revised its program to be more cost effective and seek out savings from new market sectors. In 2002, CCWD replaced the ULFT Rebate program with a ULFT Distribution Program, which resulted in improved water savings, and reduced program costs. During 2003, CCWD began several new programs, including the Restaurant Pre-Rinse Spray Valve and Commercial Clothes Washer Rebate programs. In the future, outdoor residential water use will likely be the most effective area for CCWD to achieve demand reductions. The Landscape Water Budget Program will continue to move forward to provide all dedicated irrigation customers with the most precise and accurate water budget possible. In 2004, CCWD began an ET Controller Replacement Program to evaluate the effectiveness of these devices. This technology has the potential to be a very effective water saving device.

CCWD's conservation program will continue to evolve to improve water savings, customer service, and to advance water conservation technology. Over the next few years, CCWD will continue to implement new and innovative programs.

3.5 EBMUD Water Conservation Market

EBMUD's water conservation program is founded on the principle of voluntary participation. EBMUD offers a broad range of services to suggest "choices" customers have to reduce their consumption and to eliminate water waste, while saving money and helping alleviate potential future water shortages due to drought conditions. EBMUD's Water Conservation Master Plan (WCMP), originally adopted in 1994, continues its emphasis on promoting voluntary conservation among customers.

Projected water savings are expected to derive from core EBMUD water conservation programs including water-use surveys, water-saving device distribution, financial incentives, and targeted education and outreach to EBMUD's diverse customer base. Additional savings are expected to result from general EBMUD education and outreach efforts, emerging technologies, and "natural replacement" of water-using equipment and appliances with high-efficiency models. Core program elements are continually evaluated for estimated water savings, level of customer activity, cost-effectiveness, and customer satisfaction and acceptance.

To improve the effectiveness of the residential water survey programs, outreach efforts increasingly focused on the larger water user with greater potential water savings. Identifying water savings potential among the 325,000 residential customers is primarily accomplished through queries of seasonal water consumption data. Direct mail remained the single most effective tool in enlisting customer participation in water surveys.

3.6 SFPUC Water Conservation Market

SFPUC Wholesale Service Area Conservation Potential

The SFPUC's water conservation objective is to identify and capture cost-effective water savings potential in the wholesale and retail service areas. In an effort to determine where the potential for water conservation lies in the wholesale customer service area, the SFPUC, in conjunction with its wholesale customers and BAWSCA, embarked on a comprehensive water demand and conservation potential study. The study employs an end-use water demand model to evaluate the cost-effectiveness of 32 water conservation measures. The Study identifies the market potential and potential for water savings of these measures. The BAWSCA section of this water conservation TM describes this market potential in more detail. The SFPUC will use the information from this Study to encourage conservation in the wholesale customer service area through regional incentive programs and technical assistance programs.

SFPUC Retail Service Area Conservation Potential

The SFPUC is currently expanding the goals and scope of these programs while developing tools to identify the most effective ways to promote conservation in the SFPUC retail service area. Replacing older model toilets has long been a program priority, and SFPUC facilitated replacements are estimated to exceed 100,000 toilets. This has been accomplished through rebate and toilet giveaway programs. In addition to toilet replacement, the SFPUC has also focused its energies on residential clothes washer rebate programs, residential water surveys, commercial and industrial water audits, irrigation survey programs and extensive water conservation education activities.

The SFPUC is currently in the process of redesigning its retail conservation programs. As indicated above, past efforts have focused on residential programs and plumbing fixture replacement. The SFPUC is looking to expand the retail conservation program to non-residential, commercial, industrial and institutional customers, who account for almost 40 percent of water use in San Francisco, representing a considerable water savings potential.

The SFPUC has developed an end-use water demand model, similar to that developed for the wholesale customers. This demand model is being used to identify water conservation measures that would be most effective based on the specific characteristics of San Francisco. Using this model, the SFPUC has identified an extensive list of 42 different water conservation measures, quantified their water savings potential, and determined their cost-effectiveness. Preliminary results indicate that there are cost-effective water savings that can be achieved by targeting restaurants, hotels and laundromats with various plumbing fixture replacement programs. Because of limited irrigation use in the residential and non-residential sector, the SFPUC will continue to target indoor consumption in these sectors. The SFPUC will investigate effective measures to target irrigation use at schools and parks throughout San Francisco. In addition, the SFPUC will be working with the San Francisco Department of Environment on a *Green Business Program and Green Building Program* that provide a voluntary certification program for local businesses that comply with water conservation, energy conservation, solid waste management, and pollution prevention.

3.7 SCVWD Water Conservation Market

SCVWD's Integrated Water Resources Planning Study (IWRP) 2003 identifies water conservation as a key component for ensuring long-term water supply reliability. IWRP 2003 reaffirms the importance of existing water use efficiency programs and recommends significant investments in additional water conservation activities.

Although existing SCVWD water conservation programs achieve savings above and beyond the targets established in the BMPs, SCVWD continues to look for cost-effective programs to reduce overall demand (it should be noted that although SCVWD is a wholesaler it implements most of the fourteen BMPs in cooperation with its water retailers). The most promising areas for additional water conservation savings are outdoor water use and commercial, industrial, and institutional (CII) uses. Although continuing advancements in water conservation make it difficult to determine what the most cost-effective programs will be in the future, SCVWD is always looking at new programs, innovative technologies, new partnerships, and funding opportunities to help meet long-term water savings goals. A number of promising programs currently being considered by SCVWD include weather-based irrigation controllers, web-based irrigation scheduling and site-specific water budget programs, as well as the installation of drought-tolerant landscaping. In addition, SCVWD will continue to monitor and test new technologies for both the residential and commercial sectors.

3.8 Zone 7 Water Conservation Market

The overall objective of Zone 7's Water Conservation program is to maximize water use efficiency throughout its service area. Zone 7 recognizes the role of water conservation in water resources management and planning. To that end, the Zone 7 Board adopted Resolution 1506 in January, 1992. That resolution affirmed Zone 7's belief "in the wise and judicious use of water" and recognized that "conservation and elimination of waste are important elements in Zone 7's overall management of its water resources." Zone 7 also recognizes water conservation as a future supply source and has taken the progressive step of including conservation measures in its Capital Improvement Program.

Zone 7 recognizes the need to identify what water conservation measures are most effective for the specific characteristics of the Zone 7 service area. A study is proposed to evaluate the cost-effectiveness and suitability of various water conservation measures for the Zone 7 service area. Possible scenarios could involve the use of models based upon ones used by SFPUC or Santa Clara Valley Water District.

Any additional water conservation measures will be implemented in conjunction with Zone 7 retailers. Zone 7 is aiming to expand the focus of its conservation programs to maximize outdoor water use efficiency in commercial as well as residential areas. Landscape water budgets need to be developed for the many commercial sites in the Tri-Valley and monitored with ET Controllers. This would allow these sites to achieve maximum water efficiency. Zone 7 also plans to conduct water efficient landscaping workshops for customers within its service area. An "Irrigation Technical Assistance Program" which would provide water auditors for property owners could be developed. Additionally, working in cooperation with retailers, residential audits can be performed to determine the effectiveness of current water conservation measures. Zone 7 has already taken preliminary steps by installing a CIMIS weather station and developing a "WaterWise Gardening" CDROM. Finally, in regards to landscape water conservation, after Zone 7 moves into its new building, the development of a demonstration garden showcasing native, water efficient landscaping should become a priority.

Additional future water conservation measures that will be examined include the expansion of Zone 7's BMP efforts. One example is to provide the option of a direct installation or distribution program and a two-tier rebate program for dual-flush toilets. Another future BMP is a "Cash for Grass" rebate in which residential customers would receive financial incentives to convert their turf into water efficient landscaping. Zone 7 should also evaluate the potential water savings from a Pre-Rinse Sprayer Program for restaurants in the service area. This program has proved successful for other Bay Area water agencies.

Zone 7's core water conservation programs have been in place for several years and have received broad public support. Much of the effort has been aimed at minimizing indoor residential water waste. At this point in time, Zone 7 needs to evaluate the effectiveness of its past endeavors and determine a future path on which to proceed. Further progress can be accomplished by implementing the programs listed above.

4.0 Implementation Issues

As described in the following paragraphs, the implementation of water conservation programs is confronted by several challenges. Bay Area agencies are continually working to develop strategies to overcome them.

4.1 Regional Characteristics

Region specific issues can be characterized into four main areas: (1) Bay Area Climate; (2) Population Density; (3) Type of Uses; and (4) Agency Operation. The following paragraphs elaborate on these areas.

- **Bay Area Climate Variations.** There is a wide variation in local climates in the Bay Area. Agencies closer to the Ocean and Bay tend to have much cooler climates and higher precipitation than areas farther inland. This results in a large variation in outdoor water use across the region. As such, water conservation programs targeting outdoor water use need to be tailored accordingly.

- **Population Density.** The population density of the Study Area also varies greatly from the urban San Francisco to more suburban areas in Alameda, Contra Costa and Santa Clara counties. Areas of higher density tend to have smaller areas of outdoor landscaping and therefore smaller outdoor water use rates.

- **Type of Users.** Water use varies depending on the user type (e.g., residential, commercial, industrial, agricultural, etc). Each agency has a unique breakdown of water use by sector. For example, in the CCWD regional service area, industrial use is 29% of total use, while in the SFPUC retail area only 1% of water use is devoted to industrial uses. Likewise, Districts such as Zone 7 and SCVWD devote relatively large percentages of water to agriculture uses compared to CCWD, EBMUD and SFPUC, which do not serve any significant agricultural demands.

- **Customer Participation.** Residential conservation programs depend on customer participation in order to achieve conservation savings goals. Both initial participation and continuation of conservation practices are critical to achieve savings. In addition, agencies have found that savings that rely solely on behavior modification can pose difficult challenges and may not be reliable in the long-term. Therefore, agencies are working to improve customer participation and seek new opportunities through capitalizing on customer preferences rather than relying only on behavior modifications.

- **Operation and Storage.** Each agency has unique operations tailored to its supply system. Conservation reduces demands in every year of implementation. Whether conserved water can be stored for use in a subsequent year depends on the carryover storage capabilities of each agency. For agencies without much storage, water not used in one year may not be available in a subsequent year. However, for agencies with significant storage capacity, it may be possible to conserve water in one year and store the amount until a subsequent dry year. The ability to store conserved water enhances the effectiveness of conservation for that agency. During wet years, surface storage reservoirs tend to be controlled by flood control operations and conserved water cannot be effectively stored when flood control releases are occurring.

4.2 Institutional Arrangement Challenges

Water conservation is unlike water infrastructure projects because conservation relies on the behaviors of end-users and their willingness to make changes, which are beyond agency control. Actual savings only come from willing participants, and sometimes the participation level and extent or duration of participation are difficult to predict.

Another institutional challenge is that annual water allocations made by the federal government for CVP contractors are typically based on historical use and do not account for conservation efforts that help reduce demand. The effect of this must be considered during planning.

4.3 Quantification Challenges

Quantifying the amount of water saved through various BMPs and conservation programs is a challenging exercise that is continually being refined. Various methods exist for calculating water savings and depending on the amount and accuracy of the data certain methods are more appropriate than others.

For example, the technical characteristics of a water saving device may be known, such as gallons per minute from a high efficiency nozzle or gallons per flush of an ultra low flush toilet, but what is less certain is whether the device is operated longer or more often due to the low flow characteristics. A single water meter at a home or business cannot parse water use information into refined categories and therefore only general estimates are available. Some agencies have performed end use studies and are carrying out research to better gauge performance. Enhanced product labeling and rating is another way to help in this area.

Similarly, outreach and education efforts are known to be effective in reducing use, but explicitly quantifying reduced use per advertisement or outreach presentation is very difficult. The reduced use is usually the result of a campaign that incorporates a variety of tools, including new devices or appliances as well as helpful information about how to save water.

5.0 Enhanced Conservation – Potential for Regional Conservation Efforts

Participating agencies are continually investigating new regional partnerships to broaden their individual conservation efforts. There are already some examples of regional conservation efforts in the study area:

- SFPUC and BAWSCA collaboration on water conservation evaluation and programs
- Several agencies working together to conduct a residential clothes washer rebate program with funding support from the CALFED Bay-Delta Program.

Fostering long-term partnerships and mutually beneficial programs among different agencies can help achieve the Bay Area's water reliability goals. One of the major tenets in the CUWCC MOU is the goal to overcome institutional barriers to conservation. Participating agencies are re-examining their own conservation and management policies in order to open channels of cooperation and partnership possibilities.

The participating agencies will continue to identify opportunities to coordinate conservation efforts and outreach. The following describes potential regional efforts that could further the goals of conservation in the Bay Area.

- **Regional Public Outreach.** The participating agencies recognize that previous conservation messages sponsored by individual participating agencies have influenced the conservation behaviors of customers served by other agencies. This extra effect is in part due to the sharing of information from agency to agency and the overlap in media markets in the Bay Area. Recognizing that regional coordination of conservation efforts and messages can be cost-effective, the participating agencies will continue to evaluate opportunities for regional outreach approaches.
- **Research Collaboration.** Agencies could collaborate to jointly investigate the effectiveness of new conservation measures. Several agencies have identified the commercial and industrial sectors as potential markets for future water savings. Therefore, research could focus on investigating and pilot-testing water saving devices for these sectors.
- **Product Labeling.** Implementing a regional product labeling program would standardize current labeling in the region and assist consumers in easily recognizing water saving devices. A regional program could potentially be modeled after EBMUD's WATERSTAR™ Conservation Certification and Product Labeling Program.

- **Bay Area School Sponsored Conservation Calendar.** Development of a Bay Area conservation calendar could be an effective means to involve local schools in regional water conservation. Schools could hold design competitions for drawings depicting conservation and each month of the calendar could feature a winning design from schools throughout the region.

- **Demonstration Garden.** Regional collaboration on a demonstration drought-resistant garden at a major event like the SF Flower and Garden Show is another possible conservation effort. It would improve the publicity of regional conservation while incorporating expertise and experience in drought-resistant gardening from all participating agencies.

- **Bay Area Landscaping Guide.** A Bay Area landscaping guide would offer information and advice for incorporating water saving devices and plants into landscaping. Agencies could pool their knowledge and build upon individually published guides and brochures. The guide would reach a large audience and may help in promoting conservation oriented landscaping on a regional level.

Many regional conservation activities have statewide application. State conservation activities, particularly the provision of financial incentives and targets through the Water Use Efficiency Program, also influence the direction of conservation programs. Section 6 elaborates on the Water Use Efficiency Program.

6.0 State Water Use Efficiency Program

State conservation programs are used to further the message and importance of water conservation in California. One of the largest efforts involves the CALFED Bay-Delta Water Use Efficiency (WUE) Program. A description of the Program, current efforts and funding activities is provided below.

6.1 Overview

The Bay Delta WUE is a joint state and federal program being implemented by the Department of Water Resources (DWR), the State Water Resources Control Board (SWRCB) and the United States Bureau of Reclamation (USBR). The WUE was established in the original CALFED Record of Decision (ROD) released in August 2000.

The goal of WUE is to advance the implementation of cost-effective water conservation and recycling practices throughout the state[9]. The programs of the WUE are implemented under four broad categories: (1) assurances, science and monitoring and evaluation, (2) water conservation and recycling loans and grants, (3) water conservation and recycling technical assistance, and (4) oversight and coordination. Since the inception the WUE has achieved several important accomplishments including[10]:

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[9] California Bay-Delta Authority. *Water Use Efficiency Program, Multi-Year Program Plan (Years 5-8).* July 2004.

[10] California Bay-Delta Authority. *Water Use Efficiency Program, Multi-Year Program Plan (Years 4-7).* August 2003.

- **Providing Financial Incentives.** Statewide WUE has issued 69 urban water conservation grants and 23 agricultural water conservation grants for a total of 40,775 AFY savings and an expected water savings of 754,621 AF from 2001 to 2003.

- **Providing Technical Assistance.** The WUE provided technical assistance to the California Urban Water Conservation Council and conducted workshops throughout California.

- **Developing BMPs performance measures.** The WUE working with stakeholders developed a draft framework for the certification of urban best management practices (BMPs).

6.2 Current Efforts

The WUE Program works extensively with CUWCC to further conservation activities. This collaboration has resulted in the following accomplishments[11]:

- Refinement Urban BMP reporting database procedures and evaluation

- Determination of revenue impacts of water conservation measures

- Distribution of Commercial, Industrial and Institutional water use efficiency leaflets

- Distribution of landscape Water Use Efficiency Labels

- State-wide spray nozzle program (funded by California Public Utilities Commission and administered by CUWCC)

- Technical regulatory related support for agencies preparing Urban Water Management Plans

Currently, the Water Use Efficiency Program is working on a 4-Year Evaluation that reflects on accomplishments and ahead at future potential water savings from conservation and recycling. This analysis will provide estimates of how much water can be conserved and recycled by 2007 and 2030 and provide the background for revising conservation targets. The original conservation targets focused on grant dollars awarded. However, the new revised targets will include volumetric estimates and will be divided into contributions towards water supply, in-stream flows and water quality.[12]

The new goals will help agencies focus efforts on gaining savings in specific areas, even as funding levels for conservation decrease. Two related efforts, development of common assumptions to use in modeling studies for CALFED storage projects and the California Water Plan (Bulletin 160) are using information generated from the WUE 4-year evaluation to incorporate conservation into state and federal water management planning.

WUE is identifying potential savings for specific regions including the Bay Area.

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[11] California Bay-Delta Authority. *Water Use Efficiency Program, Multi-Year Program Plan (Years 5-8).* July 2004.
[12] California Bay-Delta Authority. *Water Use Efficiency Program, Multi-Year Program Plan (Years 5-8).* July 2004.

6.3 Funding

The original budget estimate for WUE over an eight year period was set at $2.9 Billion. Due to budget constraints this estimate has decreased to about $1.0 Billion[13]. This sum covers the entire duration of years one through eight of the WUE program. This decrease in funding may adversely affect the ability to meet future conservation goals. In order to sustain program effectiveness with a limited budget, the WUE Program has and continues to seek more efficient measures by which to achieve water savings. In particular, the WUE Program has established several important objectives directly relating to improving the efficiency of program outcomes. These objectives include[14]:

- Reducing existing irrecoverable losses (i.e. reducing losses of water into salt sinks, inaccessible aquifers, etc)
- Achieving multiple benefits
- Preserving local flexibility
- Utilizing incentive-based over regulatory action
- Building on existing water use efficiency programs

The WUE Program has disbursed millions of dollars to Bay Area Agencies to complete various water use efficiency projects. Statewide, over $18 M was given to conservation related programs in 2003.

Table E6-9 lists the Bay Area projects and amounts granted through the WUE.

Table E6-9
Bay Area WUE Grants, 2003 (1)

Project	Grant
ET Controller Installation at 6 City Parks	$50,000
Targeted Multi Family Toilet Replacement Project	$203,670
X-Ray Processor Recycling Capital Outlay Project	$152,400
Regional Resources Efficient Clothes Washer Rebate	$2,190,000
ET Controller Installation Project	$1,660,000
Targeted Irrigation System Hardware Upgrades	$100,000
Innovative High Efficiency Commercial Equipment Retrofits	$500,000

(1) California Bay-Delta Authority. *2003 Proposition 13 Urban Water Conservation Program Final Funding Recommendations.* April 2003.

Participating agencies will continue to look to the WUE Program for both financial and technical support in the future.

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[13] California Bay-Delta Authority. *Water Use Efficiency Program, Multi-Year Program Plan (Years 5-8).* July 2004.

[14] California Bay-Delta Authority. *Final 2004 Water Use Efficiency Proposal Solicitation Package.* November 15, 2004.

7.0 Environmental Analysis

This section summarizes the environmental analysis for this concept. No environmental scorecard would be prepared for this concept.

7.1 Potential Environmental Benefits

Environmental benefits are defined as an overall improvement to some aspect of environmental quality, to the land, air, or water.

Enhanced (regional) conservation programs would include, but not be limited to public outreach, product demonstration garden, and not-yet-identified emerging technologies that provide water savings to residential, commercial, and industrial customers. Implementation of conservation programs would not result in direct physical changes to the environment, as they would either be social programs that increase awareness of water conservation, or product replacement that would increase water use efficiency. As such, no direct impacts to the environment would occur. If physical changes occur indirectly from these programs (e.g., minimizing wasted water during landscaping watering), the impact would be positive (e.g., reduction in the over-watering of some plants may improve their survivability, health, and aesthetic quality). Water conservation generally would result in long-term benefits to the environment. It would increase water use efficiency and reduce overall water demand, which may be particularly important during peak periods of drought years when existing water sources are strained and any offset would relieve impacts on production of other supplies (e.g., pumping of groundwater). Reduction in water demand could also potentially delay the need for development of supplemental water supplies or reduce facilities associated with development of such supplies. Therefore, implementation of conservation programs would not likely result in adverse impacts to the environment.

7.2 Potential Environmental Impacts

No adverse environmental impacts have been identified for these concepts, as described above.

8.0 Conclusion

The Bay Area has achieved tremendous water savings through conservation programs. In fact, the Pacific Institute, a water think-tank, gave the area the highest rating compared to five other regions in the state in terms of overall conservation efforts.[15] The Bay Area is poised to use this momentum to further improve the effectiveness and water efficiency rates in the Bay Area and is currently projecting over 180,000 AF in conservation-related savings by 2020[16]. Additional savings will be made possible as new technologies emerge and an increased commitment to conservation funding is raised.

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[15] The ratings were done by the Pacific Institute in their November 2003 report, "*Waste Not, Want Not: The Potential of Urban Water Conservation in California).* . Regions were ranked according to Urban Water Management Plans, Recycled Water Use, BMPs, and $ spent on BMPs.

[16] RMC. *BAWAC Advancements in Conservation.* October 2003.

9.0 Outstanding Issues

There are no outstanding issues or questions.

10.0 References

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Appendix F

BAWQ&SRP Objectives and Performance Measures

Appendix F
BAWQ&SRP Objectives and Performance Measures

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Appendix F
BAWQ&SRP Objectives and Performance Measures

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The Bay Area Water Quality and Supply Reliability Program (BAWQ&SRP) seeks to identify regional opportunities for enhancing each Bay Area water agency's water resources situation.

Developing clear objectives (i.e., the fundamental end to be achieved) is an essential step for this program. Objectives used in the evaluation process should be:

- *Measurable*. The degree to which an alternative or project can achieve an objective should be measurable.
- *Non-Redundant*. There should be no overlap between the objectives.
- *Concise*. The number of objectives should be kept manageable, especially primary objectives.
- *Understandable*. Objectives should be easily explainable to policy makers and the public.

These objectives and their associated performance measures (i.e., the metrics which indicate the degree to which the objectives are being realized) form the basis for the analysis of the various regional options. These options may consist of single concepts, or several concepts bundled into a program option (termed portfolio). This technical memorandum details the planning objectives and performance measures that are core to this evaluation. The participating agencies include the following: Alameda County Water District (ACWD); Bay Area Water Supply and Conservation Agency (BAWSCA); Contra Costa Water District (CCWD); East Bay Municipal Utility District (EBMUD); San Francisco Public Utilities Commission (SFPUC); Santa Clara Valley Water District (SCVWD); and the Zone 7 Water Agency (Zone 7).

Overview

BAWQ&SRP focuses on developing water resource concepts and combining them into example strategies (termed example portfolios) that engineering-wise and operationally have the potential to improve the participating agencies' water quality and/or water supply reliability.

This current effort is part of Phase 2 of BAWQ&SRP (formerly referred to as Bay Area Blending and Exchange Project), which seeks to perform a detailed evaluation of a variety of project concepts and example portfolios.

Project Overview

- *Phase 1 – Initial Assessment:* Compiled information of each system, water quality and water demands. This was completed under a separate contract.

- *Phase 2 – Feasibility Studies:* Develop alternatives, evaluate and identify a variety of projects and project portfolios, including preliminary environmental review. This is the focus of the present contract.

- *Phase 3 & 4 – Detailed Evaluation:* Selection, environmental review, financing, implementation plan, design and operations plan. These phases are no longer planned to be funded.

Evaluation Framework

The evaluation of concepts and portfolios involves seven steps:

1. Defining objectives and performance measures.
2. Identifying and developing water supply building blocks (termed project concepts).
3. Building example water supply investment portfolios.
4. Evaluating concepts and example portfolios.
5. Developing risk scenarios.
6. Testing concept and example portfolio performance under various risk scenarios.
7. Developing flexible resource strategies through scenario planning.

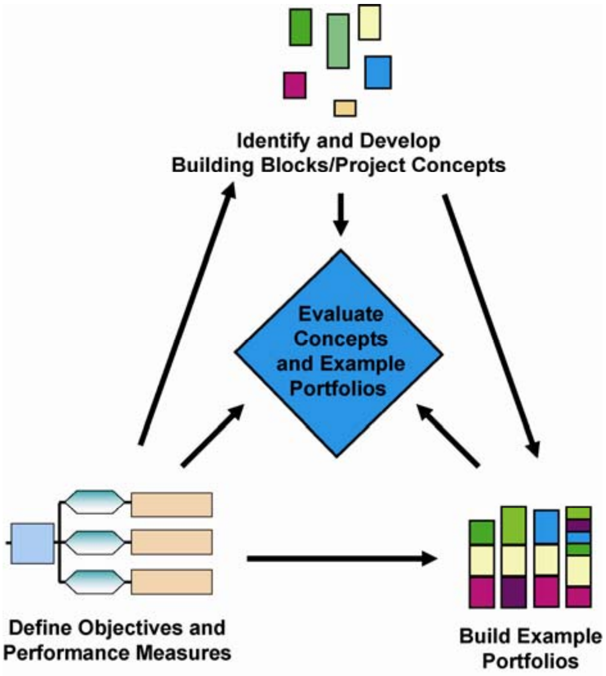
Identify and Develop
Building Blocks/Project Concepts
Evaluate Concepts and Example Portfolios
Define Objectives and Performance Measures
Build Example Portfolios

Figure F-1
Evaluation Framework

This process is depicted in Figure F-1.

In measuring the performance of a broad range of water resource options against the planning objectives, tradeoffs between portfolios will be explored, and various water resource strategies identified.

Defining BAWQ&SRP Objectives

Although there are many analytical approaches that can be used to aid decision-making, the one common element that exists in virtually all approaches is the need to identify objectives. Objectives are the reasons "why" an organization exists. Objectives can be expressed at various levels of detail starting at the most fundamental (primary) and working down to the more specific. Primary objectives help an organization communicate its purpose to policy makers, governing boards, and the public. For example, the specific objective "ensuring adequate water recycling" may not adequately convey a public call to action, while the broad primary objective of "protecting the environment" would.

A distinguishing feature of the process being proposed for BAWQ&SRP is that policy issues (as expressed by objectives) are kept separate from the technical options. The interface is that the performance measures must be applied to each concept and example portfolio.

In separate efforts, the Bay Area Water Agency Coalition (BAWAC) developed objectives and performance measures for this project. These objectives and performance measures were also reviewed with the individual participating agencies. The environmental water caucus and environmental stakeholder representatives have developed preliminary objectives and performance measures.

For BAWAC, the group met in workshops on two occasions with follow-up comments provided by the participants. Five primary objectives were identified to express the shared mission of the participating agencies. These five objectives are:

1. Supply Reliability
2. Public Health Protection
3. Cost Impacts
4. Environmental Impacts
5. Implementation Potential

Within each of these primary objectives, a set of more detailed secondary objectives was developed. Substantial input was made by technical support staff from BAWAC member agencies in the development and wording of these sub-objectives. Table F-1 reflects the final list of primary and secondary objectives.

While these objectives and performance measures are shared amongst the various water agencies that make up BAWAC, individual agencies also have their own particular objectives. BAWAC and the individual agencies agreed to the objectives and performances measures as providing sufficient information for evaluating their participation in the various portfolios that are developed.

Table F-1
Shared Objectives and Performance Measures for Bay Area Water Agency Coalition (BAWAC)

Objective and Sub-Objective	***Local Agency Perspective Performance Measure***	***Regional Perspective Performance Measure***	***Data Inputs***
Supply Reliability			
Meet Demands	Mixed qualitative and quantitative description as to incremental supply as compared to demand.	Mixed qualitative and quantitative description as to incremental supply as compared to demand, the population base affected and the number or agencies receiving benefits.	1. Baseline demands for each agency (wet, normal, dry). 2. Incremental supply yield from portfolio by agency (wet, normal, dry). 3. Population base per agency.
Vulnerability	Narrative description as to the relative amount of supply dependent on common hydrology/infrastructure for region.	Degree to which vulnerability is decreased, the population based affected and the number of agencies receiving benefits.	1. Sources of where new supply originates. 2. Major conveyance systems used by agencies to transport water. 3. Major treatment facilities.
Control within the Region	Degree of dependency on state and federal control of projects and involvement of other beneficiaries (e.g., Environmental Water Account).		1. Who constructs/operates portfolios? 2. Are portfolios to be used for other beneficiaries outside region?
Public Health Protection			
Disinfection By-Products	Projected levels of disinfection by-products in delivery water compared to baseline.	Level of reduction in disinfection by-products in delivery water as compared to baseline, the population base affected, and the number of agencies receiving benefits.	1. Levels of TOC and bromide in source water. 2. Current/planned treatment processes for each agency.
Total Dissolved Solids	Projected levels of TDS in delivery water compared to baseline.	Projected reductions in TDS as compared to baseline, the population base affected, and the number of agencies receiving benefits.	1. Levels of TDS in existing and new source waters. 2. Current/planned treatment processes for each agency.
Variability for Treatment	Degree of variability in source water and implications for treatment.	Reduction in variability as compared to baseline, the population base affected, and the number of agencies receiving benefits.	1. pH changes of source water. 2. Temperature changes of source water.
Taste and Odor Problems	Incidence of taste/odor problems.	Reduction in taste/odor problems as compared to baseline, the population base affected, and the number of agencies receiving benefits.	1. Source of water (Delta, reservoir, treatment process). 2. Susceptibility of source to algal blooms. 3. TDS of source water.
Cost Impacts			
Total Cost	Projected total lifecycle cost (both capital and O&M over life of projects).		1. Capital cost, financed over life of portfolio. 2. O&M cost (non-escalated). 3. Environmental mitigation costs (if any). 4. Assumed finance rate.
Allocation of Costs	Narrative outlining the degree to which benefits (e.g., water yield, water quality, etc.) and cost are balanced for involved agencies.		1. Total lifecycle cost for each agency. 2. Total new water yield for each agency.
Potential Environmental Impacts			
Overall Impacts to Environment	Projected overall impacts (e.g., from impacts to sensitive aquatic, terrestrial, and wetland resources, and special-status species, as well as increases in energy consumption and pollutant emissions).		1. Qualitative assessment of overall environmental impacts, before and after mitigation has been factored in.
Overall Benefits to Environment	Narrative description of projected overall benefits to the natural environment, including benefits to Delta resources.		1. Qualitative assessment of overall environmental benefits, before and after mitigation has been factored in.
Implementation Potential			
External Support	Projected degree of external support.		1. Qualitative assessment of level of external support.
Ability to Get Outside Funding	Qualitative assessment of opportunities for outside funding.		1. Qualitative assessment of outside funding.
Internal Consistency with Agency Plans and Baselines	Degree of consistency with agency plans.		1. Information on local plans and projects.

Note: These objectives and performance measures represent the shared objectives of BAWAC, but do not include all the objectives and performance measures that will be used by each agency to independently evaluate the performance of the various project portfolios.

The environmental sub-objectives and performance measures against which portfolios and concepts will be evaluated are shown in Table F-2.

Table F-2
Draft Performances Measures to Assess "Protect the Environment"

Sub-Objective	***Performance Measure***	***Comments***
Aquatic Environment	Potential Impacts to the Aquatic Environment	• Address potential for temporary construction and long-term operation effects to aquatic resources • Note benefits, if any, to aquatic resources from offset of pumping at the Delta
Terrestrial Environment	Potential Impacts to the Terrestrial Environment (acreage affected)	• Address potential for temporary construction effects to terrestrial resources (e.g., habitats) • Address potential long-term removal or loss of terrestrial resources (e.g., habitats) from facilities siting
Wetlands	Potential Effects to Wetland Resources (acreage affected)	• Address potential for temporary construction effects to wetland resources (e.g., wetlands, vernal pools) • Address potential for long-term removal or loss of wetland resources (e.g., wetlands, vernal pools) from facilities siting
Special Status Species	Potential impacts to special-status species (number of species)	• Address temporary construction or long-term operation effects to special-status plant and wildlife species
Energy Consumption	Potential for Increase in energy consumption required for operation	• Note energy consumption associated with facility operation, consider energy recovery and pumping offsets
	Potential for Increase in Criteria Pollutants Emissions	• Note potential for increase in SOX, NOX, ROG, and CO production

Summary

The objectives and associated performance measures represent the various participating agencies' best understanding of what is important to consider in developing a water resource strategy. While the associated evaluation framework presents a basis for first iteration at the overall evaluation of portfolios, a number of additional factors were considered in establishing BAWQ&SRP.